48HX030-060
Dual Fuel Heat Pump Units

Installation, Start-Up and Service Instructions

CONTENTS

NOTE TO INSTALLER — READ THESE INSTRUCTIONS CAREFULLY AND COMPLETELY before installing this unit (Fig. 1). Also, make sure the User's Manual and Replacement Guide are left with the unit after installation.

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

Understand the signal words — DANGER, WARNING, and CAUTION. Danger identifies the most serious hazards which will result in severe personal injury or death. Warning indicates a condition that could result in personal injury. Caution is used to identify unsafe practices which would result in minor personal injury or product property damage.

⚠ WARNING

Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, fire, or an explosion which can result in personal injury or unit damage. Consult a qualified installer, service agency, or gas supplier for information or assistance. The qualified installer or agency must use only factory-authorized kits or accessories when modifying this product.

⚠ WARNING

Before performing service or maintenance operations on unit, turn off gas supply *then* unit main power switch. Electrical shock could cause personal injury.

General — The 48HX units (see Fig. 1) are fully self-contained, combination electric heat pump units with gas-fired back-up heat. The units are designed for outdoor installation. See Fig. 2-5 for unit dimensions. All unit sizes have discharge openings for both horizontal and downflow configurations, and are factory shipped with all 4 duct openings covered. Units may be installed either on a rooftop or a ground-level cement slab. See Fig. 6 for roof curb dimensions.

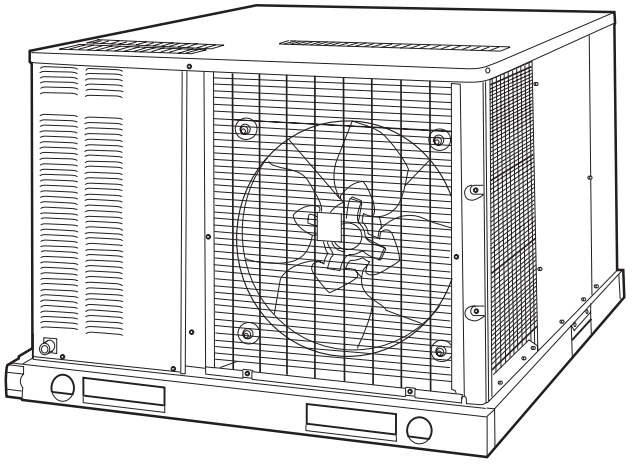


Fig. 1 — Typical 48HX Unit Shown with Optional Base Rail

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

Book 1 4 | PC 111 | Catalog No. 534-722 | Printed in U.S.A. | Form 48HX-3SI | Pg 1 | 9-98 | Replaces: 48HX-2SI

Tab 5a 5a

REQ'D CLEARANCES FOR SERVICING. in. (mm)

Duct Panel	0
Unit Top	36 (914.4)
Side Opposite Ducts	36 (914.4)
Compressor Access	36 (914.4)

(Except for NEC requirements)

REQ'D CLEARANCES TO COMBUSTIBLE MAT'L. in. (mm)

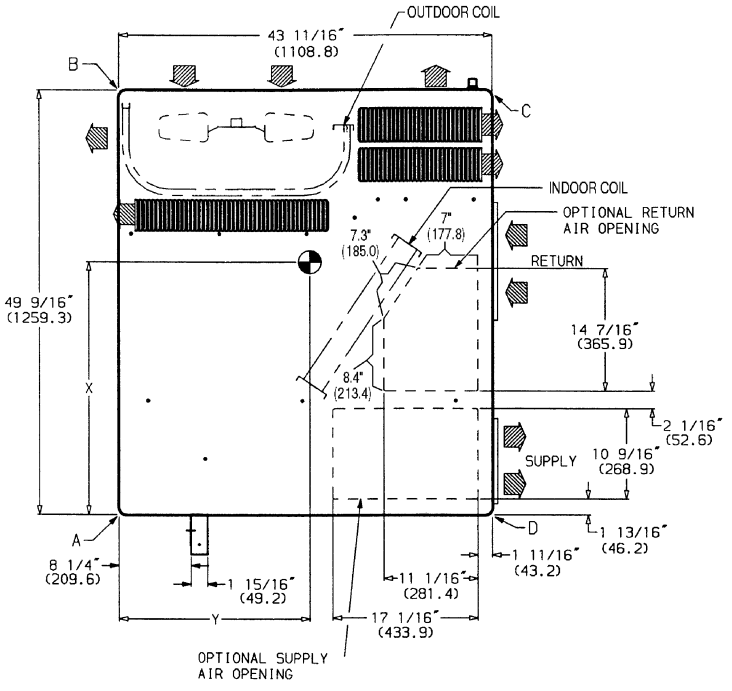
Maximum Extension of Overhangs	48 (1219.2)
Unit Top	14 (355.6)
Duct Side of Unit	2 (50.8)
Side Opposite Ducts	14 (355.6)
Bottom of Unit	0
Flue Panel	36 (914.4)

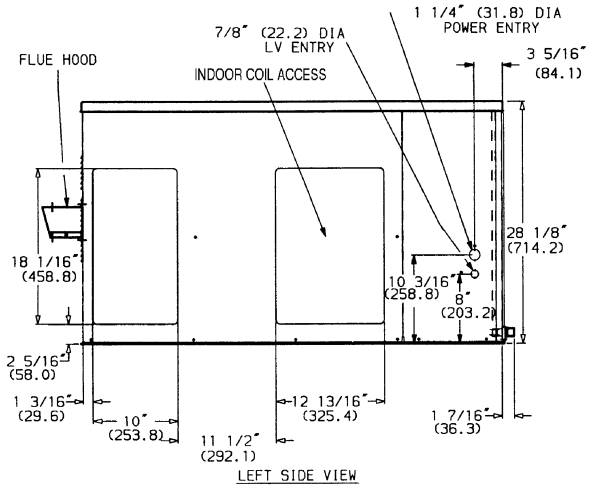
NEC (National Electrical Code) REQ'D CLEARANCES. in. (mm)

Between Units, Control Box Side	42 (1066.8)
Unit and Ungrounded Surfaces, Control Box Side	36 (914.4)
Unit and Block or Concrete Walls and Other Grounded Surfaces, Control Box Side	42 (1066.8)

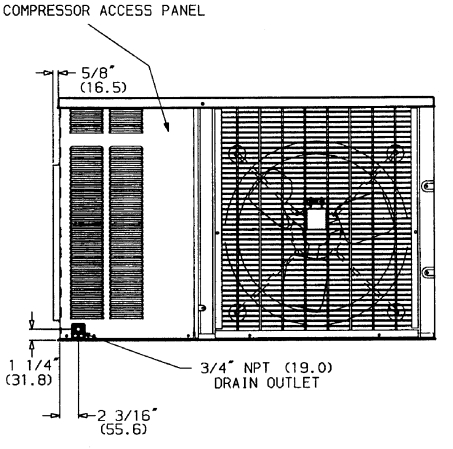
UNIT 48HX	CENTER OF GRAVITY (in./mm)		
	X	Y	Z
030040	26.99/686	22.62/575	12.65/321
030060	26.90/684	22.62/575	12.65/321

NOTES:
1. Clearances must be maintained to prevent recirculation of air from outdoor-fan discharge.
2. ⊕ indicates center of gravity.

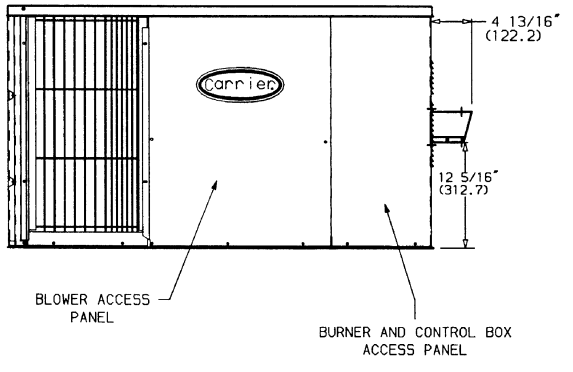




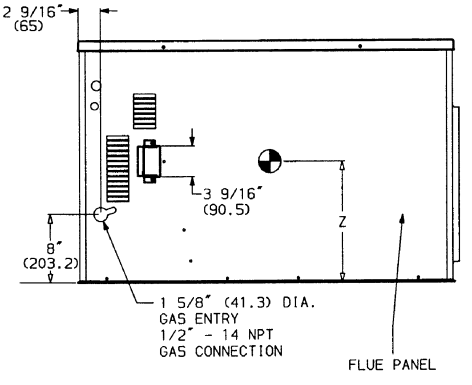
LEFT SIDE VIEW



FRONT VIEW



RIGHT SIDE VIEW



REAR VIEW

UNIT 48HX	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		CORNER WEIGHT (lb/kg)			
		lb	kg	A	B	C	D
030040	208/230-1-60, 208/230-3-60	346	157	99/45	69/31	120/55	58/26
030060	208/230-1-60, 208/230-3-60	358	163	102/46	72/33	123/56	61/28

Fig. 2 — Unit Dimensions, 48HX030 and 036 Without Base Rail

REQ'D CLEARANCES FOR SERVICING. in. (mm)

Duct Panel 0
Unit Top 36 (914.4)
Side Opposite Ducts 36 (914.4)
Compressor Access 36 (914.4)
(Except for NEC requirements)

REQ'D CLEARANCES TO COMBUSTIBLE MAT'L.

in. (mm)

Maximum Extension of Overhangs 48 (1219.2)
Unit Top 14 (355.6)
Duct Side of Unit 2 (50.8)
Side Opposite Ducts 14 (355.6)
Bottom of Unit 0
Flue Panel 36 (914.4)

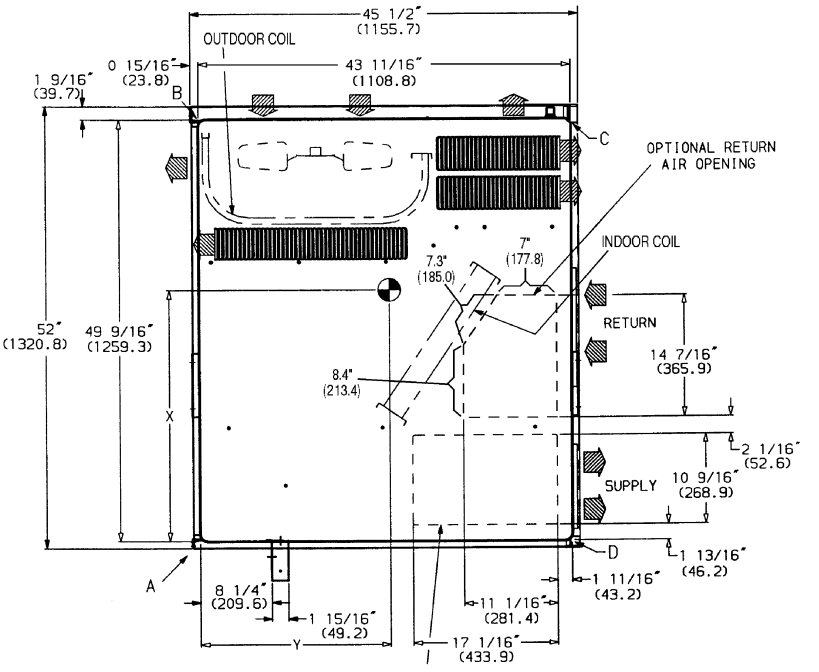
NEC (National Electrical Code) REQ'D CLEARANCES

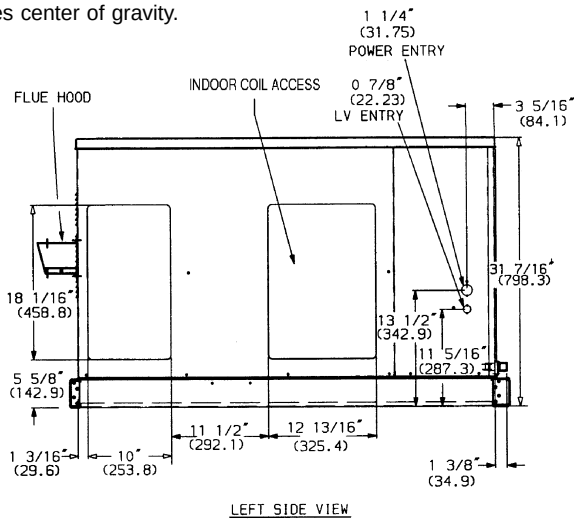
in. (mm)

Between Units, Control Box Side 42 (1066.8)
Unit and Ungrounded Surfaces, Control Box Side 36 (914.4)
Unit and Block or Concrete Walls and Other Grounded Surfaces, Control Box Side 42 (1066.8)

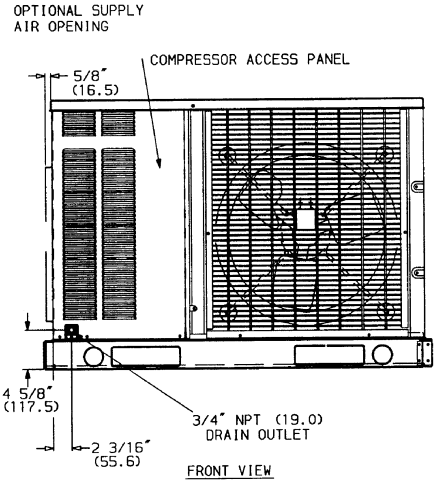
UNIT 48HX	CENTER OF GRAVITY (in./mm)		
	X	Y	Z
030040	26.85/682	23.25/590	15.96/405
030060	26.75/680	23.25/590	15.96/405

NOTES:
1. Clearances must be maintained to prevent recirculation of air from outdoor-fan discharge.
2. ⊕ indicates center of gravity.

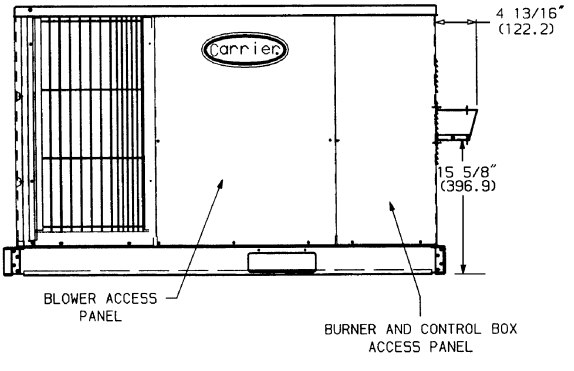




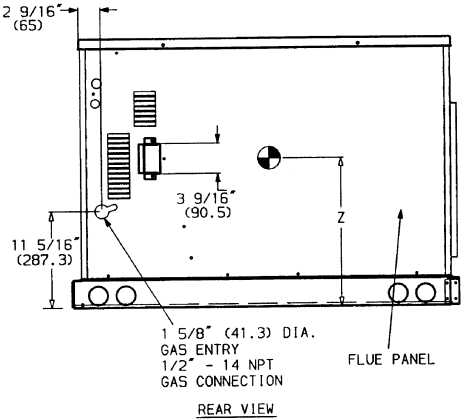
LEFT SIDE VIEW



FRONT VIEW



RIGHT SIDE VIEW



REAR VIEW

UNIT 48HX	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		CORNER WEIGHT (lb/kg)			
		lb	kg	A	B	C	D
030040	208/230-1-60, 208/230-3-60	370	169	105/48	75/34	126/57	64/29
030060	208/230-1-60, 208/230-3-60	382	174	108/49	78/35	129/59	67/30

Fig. 3 — Unit Dimensions, 48HX030 With Optional Base Rail

REQ'D CLEARANCES FOR SERVICING. in. (mm)

Duct Panel	0
Unit Top	36 (914.4)
Side Opposite Ducts	36 (914.4)
Compressor Access (Except for NEC requirements)	36 (914.4)

REQ'D CLEARANCES TO COMBUSTIBLE MAT'L. in. (mm)

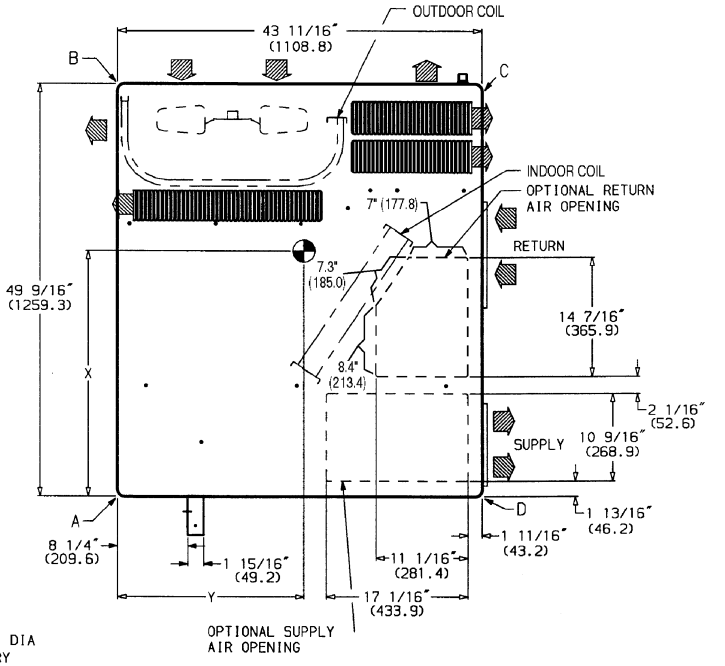
Maximum Extension of Overhangs	48 (1219.2)
Unit Top	14 (355.6)
Duct Side of Unit	2 (50,8)
Side Opposite Ducts	14 (355.6)
Bottom of Unit	0
Flue Panel	36 (914.4)

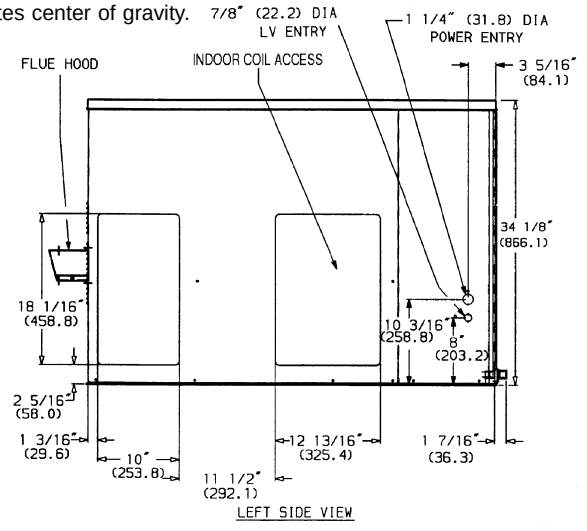
NEC (National Electrical Code) REQ'D CLEARANCES. in. (mm)

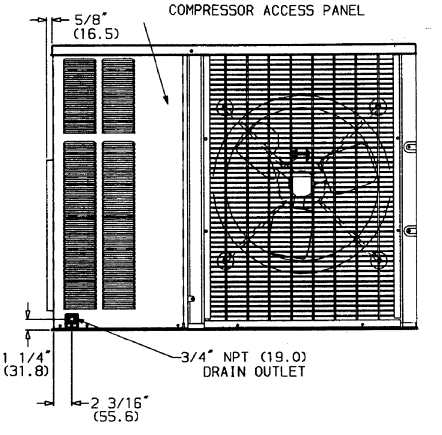
Between Units, Control Box Side	42 (1066.8)
Unit and Ungrounded Surfaces, Control Box Side	36 (914.4)
Unit and Block or Concrete Walls and Other Grounded Surfaces, Control Box Side	42 (1066.8)

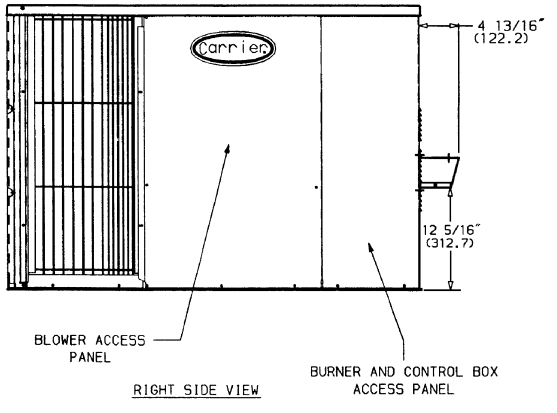
UNIT 48HX	CENTER OF GRAVITY (in./mm)		
	X	Y	Z
036060/080	28.38/720	22.75/604	15.35/390
048080/100	28.38/720	23.75/604	15.35/390
060080/100	28.06/713	23.60/599	15.35/390

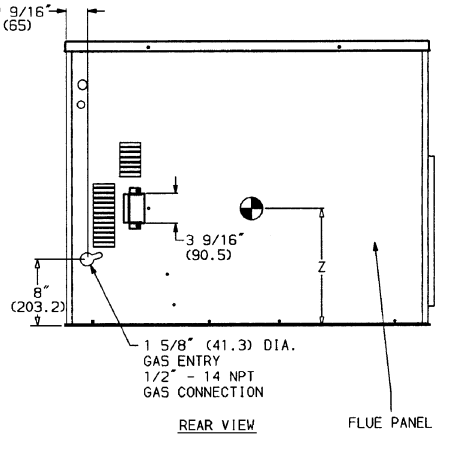
NOTES:
1. Clearances must be maintained to prevent recirculation of air from outdoor-fan discharge.
2. ⊕ indicates center of gravity.











UNIT 48HX	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		CORNER WEIGHT (lb/kg)			
		lb	kg	A	B	C	D
036060/080	208/230-1-60, 208/230-3-60 460-3-60	432	196	111/50	88/40	160/73	73/33
048080/100	208/230-1-60, 208/230-3-60	432	196	111/50	88/40	160/73	73/33
060080/100	208/230-1-60, 208/230-3-60	463	210	119/54	96/44	167/76	81/37

Fig. 4 — Unit Dimensions, 48HX036-060 Without Base Rail

REQ'D CLEARANCES FOR SERVICING. in. (mm)

Duct Panel	0
Unit Top	36 (914.4)
Side Opposite Ducts	36 (914.4)
Compressor Access (Except for NEC requirements)	36 (914.4)

REQ'D CLEARANCES TO COMBUSTIBLE MAT'L. in. (mm)

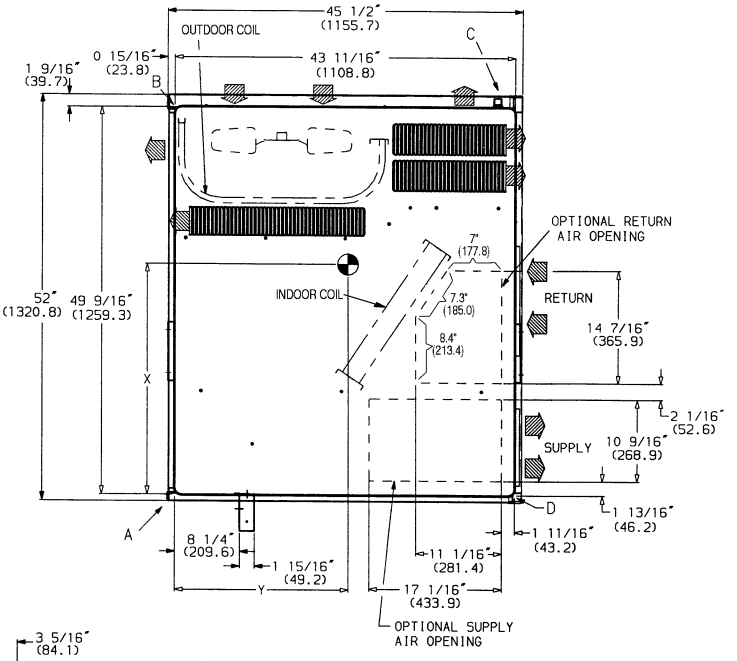
Maximum Extension of Overhangs	48 (1219.2)
Unit Top	14 (355.6)
Duct Side of Unit	2 (50.8)
Side Opposite Ducts	14 (355.6)
Bottom of Unit	0
Flue Panel	36 (914.4)

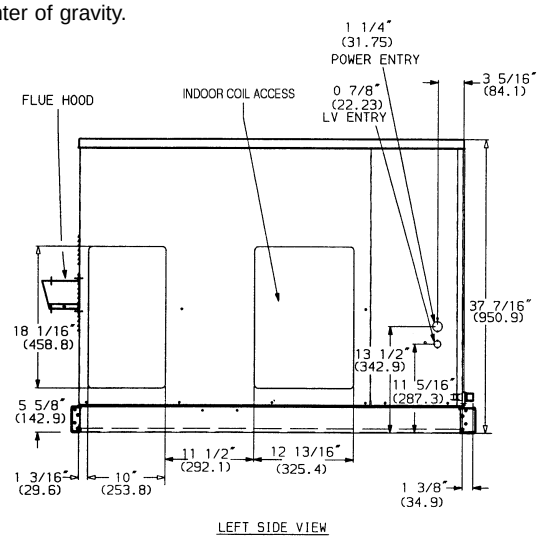
NEC (National Electrical Code) REQ'D CLEARANCES. in. (mm)

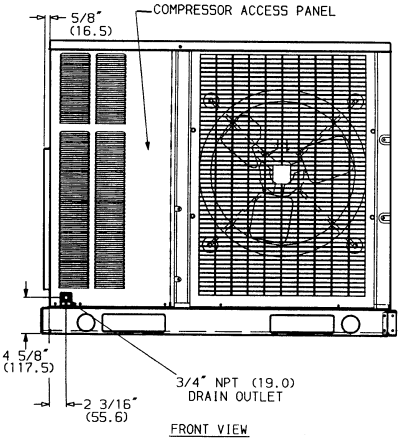
Between Units, Control Box Side	42 (1066.8)
Unit and Ungrounded Surfaces, Control Box Side	36 (914.4)
Unit and Block or Concrete Walls and Other Grounded Surfaces, Control Box Side	42 (1066.8)

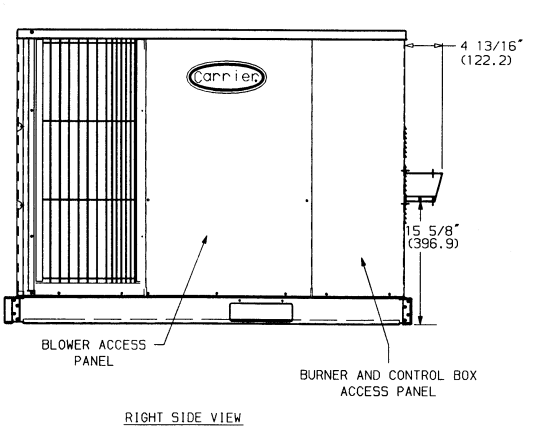
UNIT 48HX	CENTER OF GRAVITY (in./mm)		
	X	Y	Z
036060/080	28.16/716	24.50/622	18.66/474
048080/100	28.16/716	24.50/622	18.66/474
060080/100	27.90/709	24.30/618	18.66/474

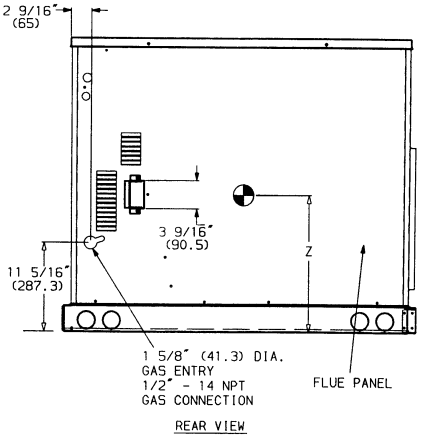
NOTES:
1. Clearances must be maintained to prevent recirculation of air from outdoor-fan discharge.
2. ⊕ indicates center of gravity.









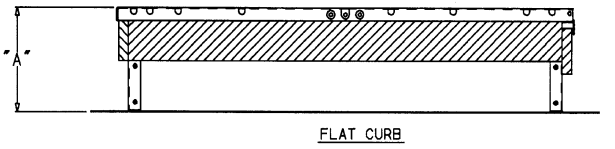


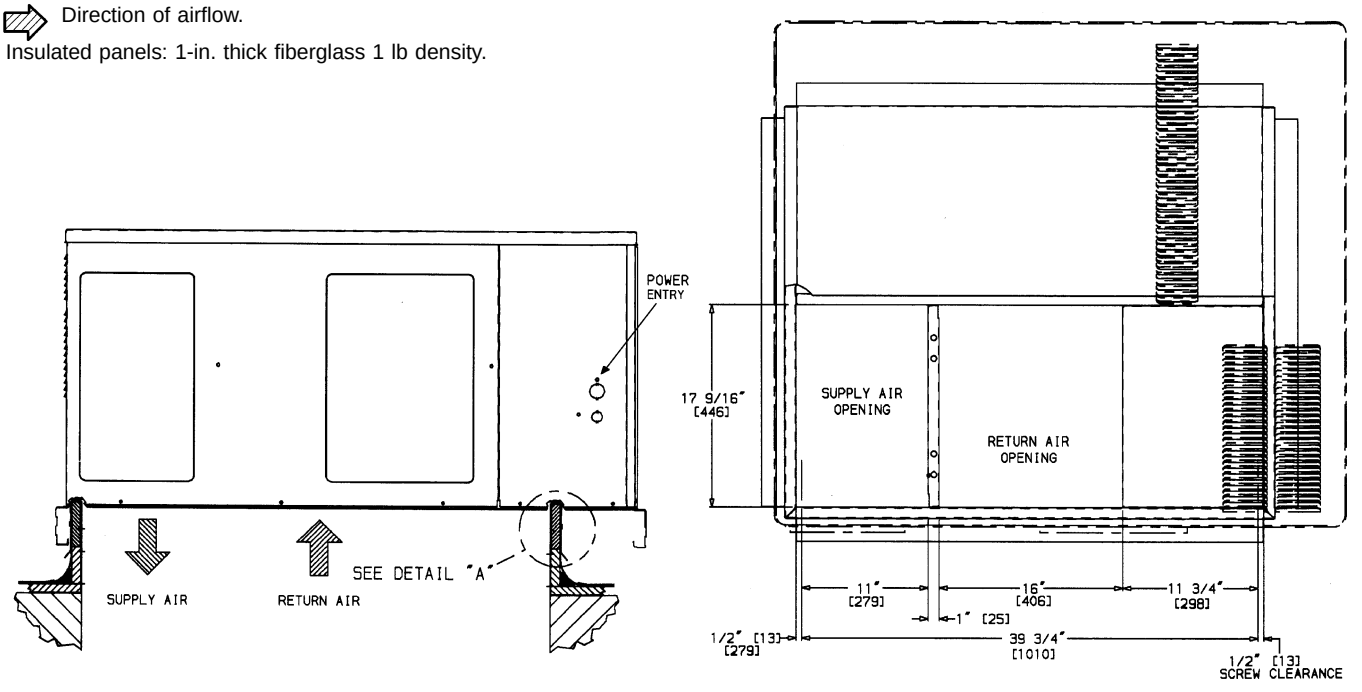
UNIT 48HX	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		CORNER WEIGHT (lb/kg)			
		lb	kg	A	B	C	D
036060/080	208/230-1-60, 208/230-3-60, 460-3-60	456	207	117/53	94/43	166/75	79/36
048080/100	208/230-1-60, 208/230-3-60	456	207	117/53	94/43	166/75	79/36
060080/100	208/230-1-60, 208/230-3-60	487	221	125/57	102/46	173/79	87/40

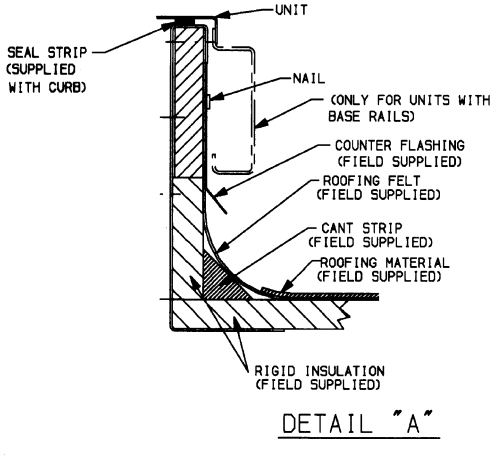
Fig. 5 — Unit Dimensions, 48HX036-060 With Optional Base Rail

	PART NUMBER	"A"
FLAT	CPRFCURB001A00	8″ [203]
	CPRFCURB002A00	11″ [279]
	CPRFCURB003A00	14″ [356]

NOTES:
1. Roof curb must be set up for unit being installed.
2. Seal strip must be applied as required for unit being installed.
3. Dimensions in [ ] are in millimeters.
4. Roof curb is made of 16 gage steel.
5. Attach ductwork to curb (flanges of duct rest on curb).
6. Service clearance 4 ft on each side.
7. ⇨ Direction of airflow.
8. Insulated panels: 1-in. thick fiberglass 1 lb density.







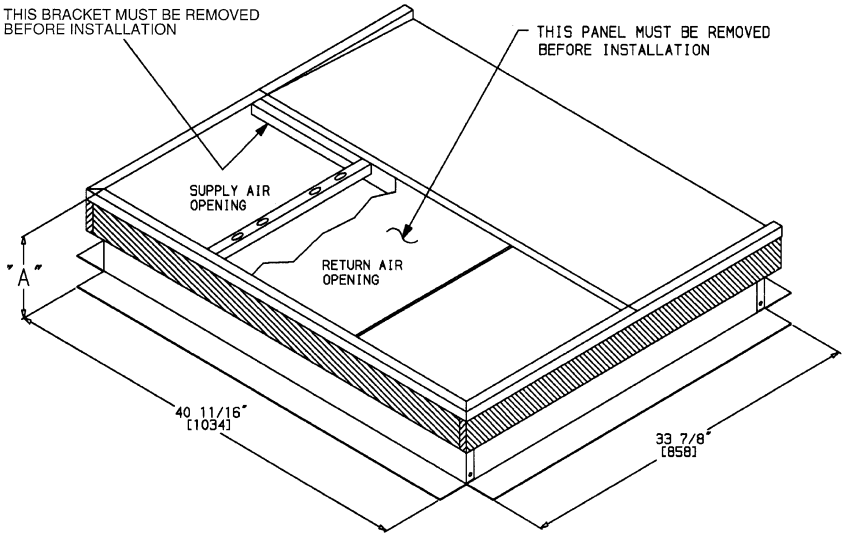


Fig. 6 — Roof Curb Dimensions

RECEIVING AND INSTALLATION

Step 1 — Check Equipment

IDENTIFY UNIT — The unit model number and serial number are stamped on unit identification plate. Check this information against shipping papers and job data.

INSPECT SHIPMENT — Inspect for shipping damage while unit is still on shipping pallet. If unit appears to be damaged or is torn loose from its anchorage, have it examined by transportation inspectors before removal. Forward claim papers directly to transportation company. Manufacturer is not responsible for any damage incurred in transit.

Check all items against shipping list. Immediately notify the nearest Carrier Air Conditioning office if any item is missing.

To prevent loss or damage, leave all parts in original packages until installation.

Step 2 — Provide Unit Support

ROOF CURB — Install accessory roof curb in accordance with instructions shipped with curb. See Fig. 6 for roof curb dimensions. Install insulation, cant strips, roofing, and flashing. Ductwork must be attached to curb.

IMPORTANT: The gasketing of the unit to the roof curb is critical for a watertight seal. Install gasketing material supplied with the roof curb. Improperly applied gasketing can also result in air leaks and poor unit performance.

Curb should be level to within ¼ inch. See Fig. 7. This is necessary for unit drain to function properly. Refer to accessory roof curb installation instructions for additional information as required.

To remove wood support under unit (with base rail only), loosen 4 screws above rigging holes and slide assembly out through rectangular hole.

SLAB MOUNT — Place the unit on a solid, level concrete pad that is a minimum of 4 in. thick with 2 in. above grade. The slab should be flush on the front of the unit (to allow condensate drain installation) and should extend 2 in. on the three remaining sides of the unit. See Fig. 8. Install a 6-in. gravel apron in front of outdoor-air inlets to prevent obstruction of airflow by grass or shrubs. Do not secure the unit to the slab *except* when required by local codes.

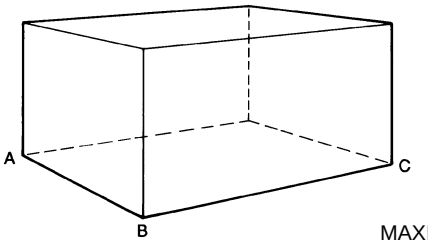
To remove wood support under unit (with base rail only), loosen 4 screws above rigging holes and slide assembly out through rectangular hole.

FLUSH MOUNT — Place side of unit with duct panel flush against transition. On units with optional base rails, the skirt on duct-panel side of unit can be removed or relocated to allow unit to be mounted flush against transitions that extend below basepan of unit. To move skirt, proceed as follows:

1. Remove 4 screws holding skirt to base rail. Retain screws.
2. Remove skirt or slide skirt inwards until alternate clearance holes align with base rails.
3. Secure with screws removed in Step 1. Holes align with base rails.

To remove wood support under unit (with base rail only), loosen 4 screws above rigging holes and slide assembly out through rectangular hole.

Step 3 — Field Fabricate Ductwork — Secure all ducts to roof curb and building structure on vertical discharge units. *Do not connect ductwork to unit*. For horizontal applications, attach ductwork to flanges on horizontal discharge openings. All ductwork should be secured to the flanges. Insulate and weatherproof all external ductwork, joints, and roof openings with counter flashing and mastic in accordance with applicable codes.



MAXIMUM ALLOWABLE DIFFERENCE (in.)

A-B	B-C	A-C
½	¼	¼

Fig. 7 — Unit Leveling Tolerances

Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier.

If a plenum return is used on a vertical unit, the return should be ducted through the roof deck to comply with applicable fire codes.

A minimum clearance is not required around ductwork. Cabinet return-air static shall not exceed −.25 in. wg.

Step 4 — Provide Clearances — The required minimum operating and service clearances are shown in Fig. 2-5. Adequate combustion, ventilation, and outdoor air must be provided.

⚠ CAUTION

Do not restrict outdoor airflow. An air restriction at either the outdoor-air inlet or the fan discharge can be detrimental to compressor life.

The outdoor fan pushes air through the outdoor coil and discharges it through the bank of louvers in the top cover, the decorative grille on the right side of the unit, and the compressor access panel. Be sure that the fan discharge does not recirculate to the outdoor coil. Do not locate the unit in either a corner or under an overhead obstruction. The minimum clearance of a partial overhang (such as a normal house overhang) is 48-inches. The maximum horizontal extension of a partial overhang must not exceed 48 inches.

Provide a minimum clearance of 42 in. for the control box side next to a block wall or any other grounded surface. Provide a minimum clearance of 42 in. between the control box side of unit and any electrically powered device, for example, another unit.

Do not place the unit where water, ice, or snow from an overhang or roof will damage or flood the unit. Do not install the unit on carpeting, tile, or other combustible materials. The unit may be installed on wood flooring or on Class A, B, or C roof covering materials.

Step 5 — Rig and Place Unit

⚠ CAUTION

When installing the unit on a rooftop, be sure the roof will support the additional weight. Refer to Fig. 2-5 for corner weight information.

Use spreader bars or crate top when rigging the unit. The units must be rigged for lifting as shown in Fig. 9. Refer to Table 1 for operating weight and to Fig. 2-5 for corner weights.

Use extreme caution to prevent damage when moving the unit. Unit must remain in an upright position during all rigging and moving operations. The unit must be level for proper condensate drainage; therefore, the ground-level pad or accessory roof curb must be level before setting the unit in place. When a field-fabricated support is used, be sure that the support is level and properly supports the unit.

UNITS WITHOUT BASE RAIL — If accessory rigging brackets are to be used for rigging, install them as follows:

⚠ WARNING

Secure screws and paint protectors solidly against unit basepan to hold lifting brackets in position.

Never use lifting brackets when the temperature is below −10 F.

Never exceed 200 lbs per bracket of lifting force.

Never use lifting brackets for lifting other models of air-conditioning units or heat pumps.

Lifting point should be directly over the unit center of gravity.

1. Position brackets as close to the corners of unit as possible. Be sure brackets are well outside of center of gravity. (See Fig. 2, 4, and 9.)
2. Position paint protectors and foam strips between screws and painted surface of unit. Tighten screws until they make contact with the paint protectors.
3. Secure device or hook of sufficient strength to hole in bracket as shown in detail "C" of Fig. 9.
4. If wood top is available, use it for a spreader bar to prevent straps from damaging unit. If wood top is not available, use spreader bars of sufficient length.

UNITS WITH OPTIONAL BASE RAIL — Refer to Fig. 9, detail A and View B-B. Lifting holes are provided in optional base rail as shown in Fig. 9. Operating weights are shown in Table 1. Refer to rigging instructions on unit.

Protective wood support must be removed from unit before unit is mounted to curb. Remove 4 screws that secure support above rigging holes in rails. Slide support out through rectangular hole in rail. See Fig. 9.

Step 6 — Connect Condensate Drain

NOTE: When installing condensate drain connection be sure to comply with local codes and restrictions.

Model 48HX disposes of condensate water through a ¾ in. NPT fitting which exits through the compressor access panel. See Fig. 2-5 for location.

Condensate water can be drained directly onto the roof in rooftop installations (where permitted) or onto a gravel apron in ground-level installations. Install a field-supplied condensate trap at end of condensate connection to ensure proper drainage. Make sure that the outlet of the trap is at least 1 in. lower than the drain-pan condensate connection to prevent the pan from overflowing. See Fig. 10. Prime the trap with water. When using a gravel apron, make sure it slopes away from the unit.

If the installation requires draining the condensate water away from the unit, install a 2-in. trap at the condensate connection to ensure proper drainage. See Fig. 10. Make sure that the outlet of the trap is at least 1 in. lower than the drain-pan condensate connection to prevent the pan from overflowing. Prime the trap with water. Connect a drain tube using a minimum of ¾-in. PVC or ¾-in. copper pipe (all field-supplied) at the outlet end of the 2-in. trap. Do not undersize the tube. Pitch the drain tube downward at a slope of at least one in. for every 10 ft of horizontal run. Be sure to check the drain tube for leaks.

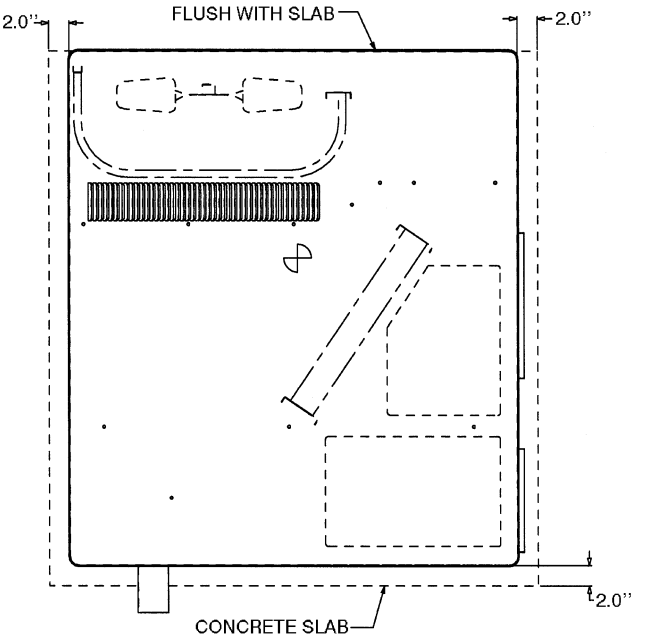


Fig. 8 — Slab Mounting Details

Step 7 — Install Flue Hood — The flue hood assembly is shipped screwed to the control box in the burner compartment. Remove the burner access panel to locate the assembly.

For units being installed in California Air Quality Management Districts which require NO_X emissions of 40 nanograms/joule or less, kit CRLOWNOX001A00 must be installed.

⚠ CAUTION

The venting system is designed to ensure proper venting. The flue hood assembly must be installed as indicated in this section of the unit installation instructions.

Install the flue hood as follows (refer to Fig. 2-5):

1. This installation must conform with local building codes and with the National Fuel Gas Code (NFGC), American National Standards Institute (ANSI) Z223.1 latest revision (in Canada, CAN/CGA [Canadian Gas Association] B149.1, [2]-M86) or NFPA (National Fire Protection Association) 54, latest revision TIA-54-84-1. Refer to Provincial and local plumbing or wastewater codes and other applicable local codes.
2. Remove from shipping location. Place vent cap assembly over flue panel. Orient screw holes in vent cap with holes in the flue panel.
3. Secure flue hood to flue panel by inserting a single screw on the right side, the left side, and the top of flue hood.

Step 8 — Install Gas Piping — The gas supply pipe enters the unit through the access hole provided. The gas connection to the unit is made to the ½-in. FPT gas inlet on the manual shutoff or gas valve.

Install a gas supply line that runs to the heating section. Refer to Table 2 and the NFGC for gas pipe sizing. Black iron pipe must be used for connections inside the unit. Check the local utility for recommendations concerning existing lines. Size gas supply piping for 0.5 in. wg maximum pressure drop. *Never use pipe smaller than the ½-in. FPT gas inlet on the unit gas valve.*

NOTICE TO RIGGERS

Hook rigging shackles through holes in lifting brackets, as shown in Details "A" and "C." Lifting brackets to be centered around the unit center of gravity. Use wooden top skid when rigging, to prevent rigging straps from damaging unit. On units with rails, remove 4 screws to slide wood support through rectangular hole in rail.

⚠ CAUTION

All panels must be in place when rigging.

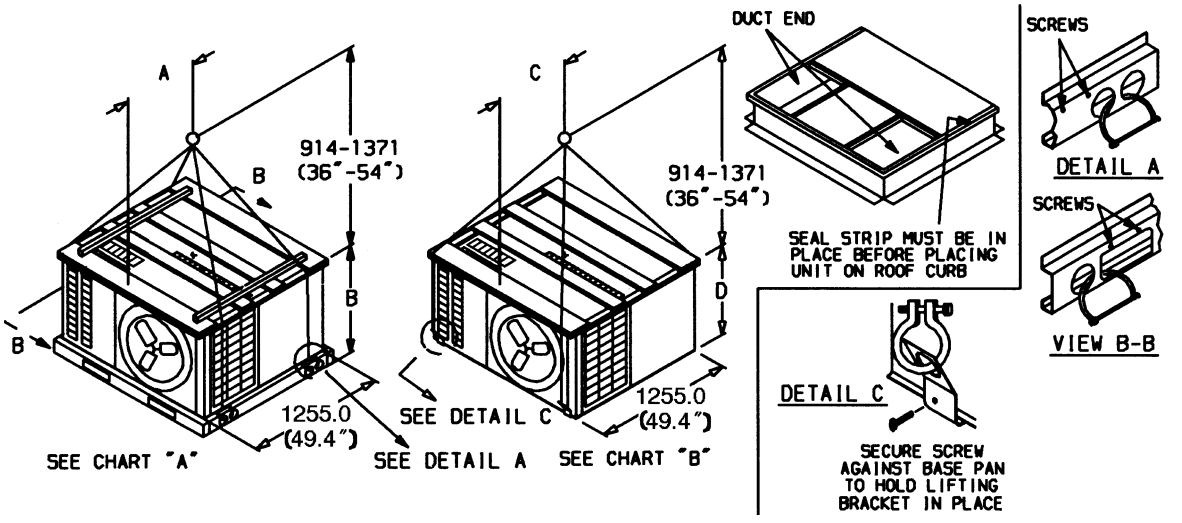


CHART "A" — UNITS WITH OPTIONAL BASE RAIL

UNIT SIZE 48HX	SHIPPING WEIGHT		A		B	
	Lb	Kg	in.	mm	in.	mm
030	401	182	22.6	575	32.2	817
036	477	217	21.2	537	38.2	969
048	477	217	21.2	537	38.2	969
060	506	230	21.5	546	38.2	969

CHART "B" — UNITS WITHOUT BASE RAIL

UNIT SIZE 48HX	SHIPPING WEIGHT		C		D	
	Lb	Kg	in.	mm	in.	mm
030	377	171	22.4	568	28.2	715
036	453	206	21.0	532	34.2	867
048	453	206	21.0	532	34.2	867
060	482	219	21.3	542	34.2	867

Fig. 9 — Suggested Rigging

Table 1 — Physical Data

UNIT SIZE 48HX	030040	030060	036060	036080	048080	048100	060080	060100
NOMINAL CAPACITY (tons)	2½	2½	3	3	4	4	5	5
OPERATING WEIGHT (lb)								
Without Base Rail	346	358	432	432	432	432	463	463
With Optional Base Rail	370	382	456	456	456	456	487	487
COMPRESSOR	Scroll							
Quantity	1							
REFRIGERANT	R-22							
Charge (lb)	5.6	5.6	8.6	8.6	7.8	7.8	8.1	8.1
OUTDOOR COIL								
Rows...Fins/in.	2...17	2...17	2...17	2...17	2...17	2...17	2...17	2...17
Face Area (sq ft)	7.00	7.00	8.66	8.66	8.66	8.66	8.66	8.66
OUTDOOR FAN (Propeller)								
Nominal Cfm	2200	2200	2200	2200	2400	2400	2400	2400
Diameter (in.)	20	20	20	20	20	20	20	20
Motor Hp	¼	¼	¼	¼	⅓	⅓	⅓	⅓
Motor Rpm	1100	1100	1100	1100	1100	1100	1100	1100
INDOOR COIL								
Rows...Fins/in.	3...15	3...15	4...15	4...15	4...15	4...15	4...15	4...15
Face Area (sq ft)	3.6	3.6	4.5	4.5	4.5	4.5	4.5	4.5
INDOOR FAN (Centrifugal)*								
Nominal Airflow (Cfm)	1000	1000	1150	1150	1600	1600	1800	1800
Size (in.)	10 x 10	10 x 10	10 x 10	10 x 10	10 x 10	10 x 10	10 x 10	10 x 10
Motor Hp	¼	¼	¼	½	1	1	1	1
Motor Rpm	1075	1075	1100	1100	Variable	Variable	Variable	Variable
FURNACE SECTION								
Heating Input† (Btuh)	40,000	56,000	56,000	80,000	80,000	95,000	80,000	95,000
Burner Orifice (Qty...drill size)								
Natural Gas	1...32	2...41	2...41	2...32	2...32	2...30	2...32	2...30
Propane Gas	1...41	2...46	2...46	2...42	2...42	2...41	2...42	2...41
RETURN-AIR FILTERS**								
Throwaway (in.)	24 x 24	24 x 24	24 x 30	24 x 30	24 x 30	24 x 30	24 x 30	24 x 30

*Sizes 048 and 060 indoor fans are equipped with an integrated control motor (ICM). The ICM provides variable speed.

†Based on an altitude of 0 to 2000 feet.

**Required filter sizes shown are based on the ARI (Air Conditioning & Refrigeration Institute) rated heating airflow at a velocity of 300 ft/min for throwaway type or 450 ft/min for high capacity type. Recommended filters are 1-in. thick.

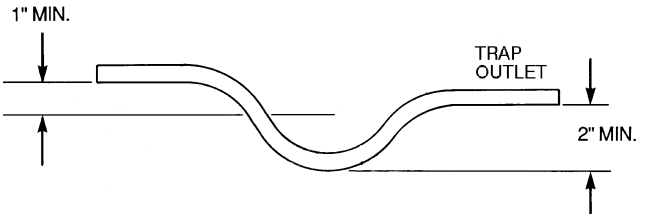


Fig. 10 — Condensate Trap

For natural gas applications, the gas pressure at unit gas connection must not be less than 4.0 in. wg or greater than 13 in. wg while the unit is operating. For propane applications, the gas pressure must not be less than 4.0 in. wg or greater than 13 in. wg at the unit connection.

When installing the gas supply line, observe local codes pertaining to gas pipe installations. Refer to the NFGC ANSI Z223.1 latest revision NFPA latest edition (in Canada, CAN/CGA B149.1, (2)-M86). In the absence of local building codes, adhere to the following pertinent recommendations:

1. Avoid low spots in long runs of pipe. Grade all pipe ¼ inch in every 15 ft to prevent traps. Grade all horizontal runs downward to risers. Use risers to connect to heating section and to meter.
2. Protect all segments of piping system against physical and thermal damage. Support all piping with appropriate straps, hangers, etc. Use a minimum of one hanger every 6 ft. For pipe sizes larger than ½ in., follow recommendations of national codes.
3. Apply joint compound (pipe dope) sparingly and only to male threads of joint when making pipe connections. Use only pipe dope that is resistant to action of liquefied petroleum gases as specified by local and/or national codes. *Never use Teflon tape.*
4. Install sediment trap in riser leading to heating section per Fig. 11. This drip leg functions as a trap for dirt and condensate.
5. Install an accessible, external, manual main shutoff valve in gas supply pipe within 6 ft of heating section.
6. Install ground-joint union close to heating section between unit gas valve and external manual gas shutoff valve.
7. Pressure-test all gas piping in accordance with local and national plumbing and gas codes.

   NOTE: The gas valve in the unit is subject to failure if exposed to pressures exceeding 0.5 psig. When pressurizing the gas line above 0.5 psig, disconnect the union located between the manual shutoff and the gas valve in the unit; this will avoid unit gas valve failure.

⚠ WARNING

Never use a match or other open flame when checking for gas leaks. Never purge gas line into combustion chamber. Failure to follow this warning could result in an explosion causing personal injury or death.

8. Using a soap and water solution, check for gas leaks at all piping connections inside and outside the unit.

Step 9 — Install Duct Connections — The unit has duct flanges on the supply- and return-air openings on the side and bottom of the unit. See Fig. 2-5 for connection sizes and locations.

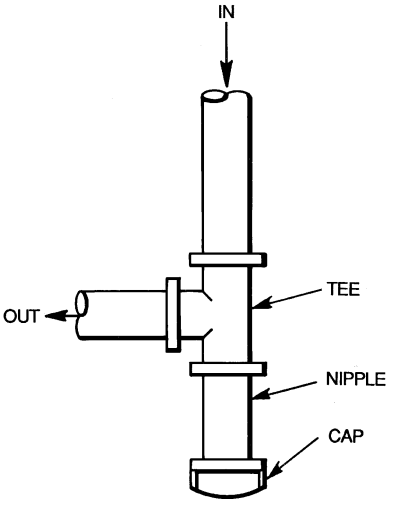


Fig. 11 — Sediment Trap

CONFIGURING UNITS FOR DOWNFLOW (Vertical) DISCHARGE

⚠ WARNING

For vertical supply and return units, tools or parts could drop into ductwork and cause an injury. Install 90-degree turns in the supply and return ductwork between the unit and the conditioned space. If a 90-degree elbow cannot be installed, then grilles of sufficient strength and density should be installed to prevent objects from falling into the conditioned space.

⚠ WARNING

Before performing service or maintenance operations on the system, turn off gas supply, then main power to unit. Failure to follow this warning could result in electrical shock and personal injury.

1. Open all electrical disconnects before starting any service work.
2. Remove return duct cover located on duct panel. Figure 12 shows duct cover removed. Save duct cover and screws.
3. Locate lances in basepan insulation that are placed over the perimeter of the vertical duct opening cover (Fig. 13).
4. Using a straight edge and sharp knife, cut and remove the insulation around the perimeter of the cover. Remove and save 5 screws securing the cover to the basepan and slide out the cover. Discard the cover (Fig. 14).
5. Remove supply duct cover located on duct panel. Figure 12 shows duct cover removed. Save duct cover and screws.
6. Remove and discard 2 screws which secure vertical discharge opening cover to basepan (Fig. 15). Slide cover forward to disengage, then tilt and remove cover through vertical discharge opening in bottom of unit. Discard duct cover (Fig. 16).

⚠ CAUTION

Collect ALL screws that were removed. Do not leave screws on rooftop as permanent damage to the roof may occur.

7. If unit ductwork is to be attached to vertical opening flanges on the unit basepan (jackstand applications only), do so at this time.
8. It is recommended that the basepan insulation around the perimeter of the vertical return-air opening be secured to the basepan with aluminum tape. Applicable local codes may require aluminum tape to prevent exposed fiberglass.
9. Cover both horizontal duct openings with the duct covers from Steps 2 and 5. Make sure opening is air- and watertight.
10. After completing unit conversion, perform all safety checks and power up unit.

NOTE: The design and installation of the duct system must be in accordance with the standards of the NFPA for installation of nonresidence-type air conditioning and ventilating systems, NFPA 90A or residence-type, NFPA 90B; and/or local codes and residence-type, NFPA 90B; and/or local codes and ordinances.

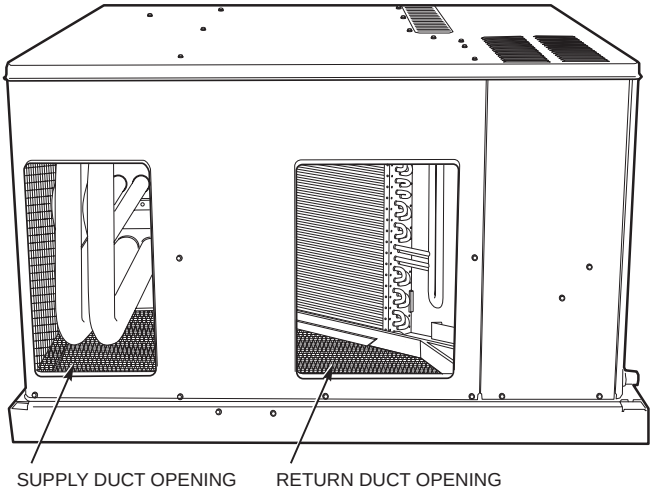


Fig. 12 — Supply and Return Duct Openings

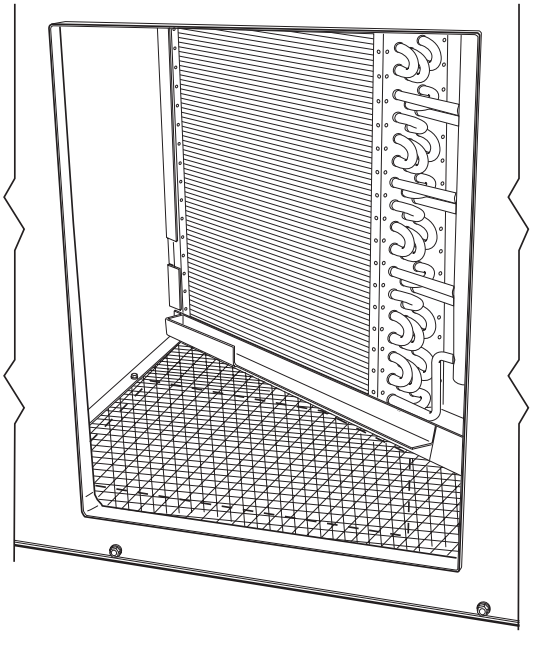


Fig. 13 — Lance Location for Vertical Duct Opening Cover

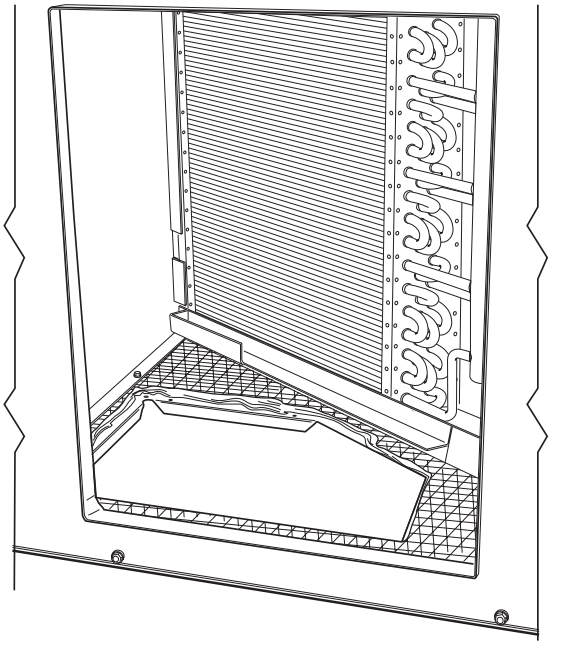


Fig. 14 — Vertical Duct Cover Removed

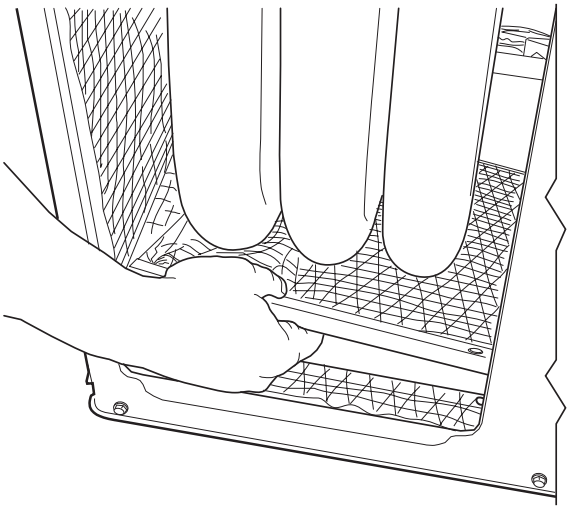


Fig. 15 — Removal of Vertical Discharge Opening Cover

Table 2 — Maximum Gas Flow Capacity*

NOMINAL IRON PIPE, SIZE (in.)	INTERNAL DIAMETER (in.)	LENGTH OF PIPE, FT†													
		10	20	30	40	50	60	70	80	90	100	125	150	175	200
½	.622	175	120	97	82	73	66	61	57	53	50	44	40	—	—
¾	.824	360	250	200	170	151	138	125	118	110	103	93	84	77	72
1	1.049	680	465	375	320	285	260	240	220	205	195	175	160	145	135
1¼	1.380	1400	950	770	600	580	530	490	460	430	400	360	325	300	280
1½	1.610	2100	1460	1180	990	900	810	750	690	650	620	550	500	460	430

*Capacity of pipe in cu ft of gas per hr for gas pressure of 0.5 psig or less. Pressure drop of 0.5-in. wg (based on a 0.60 specific gravity gas). Refer to Table C-4, National Fire Protection Association NFPA54.
†This length includes an ordinary number of fittings.

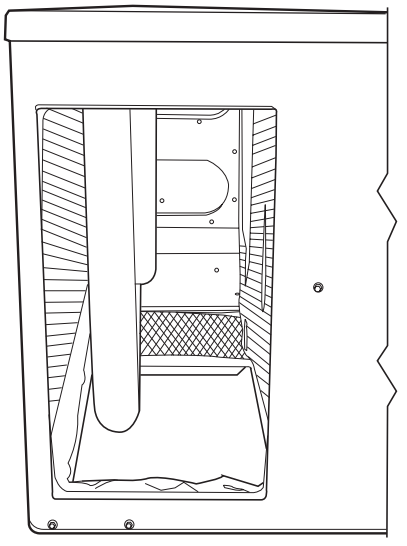


Fig. 16 — Vertical Discharge Cover Removed

Adhere to the following criteria when selecting, sizing, and installing the duct system:

1. Units are shipped with all 4 duct openings covered. Remove appropriate panels for intended installation.
2. Select and size ductwork, supply-air registers, and return-air grilles according to American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) recommendations.
3. Use flexible transition between rigid ductwork and unit to prevent transmission of vibration. The transition may be screwed or bolted to duct flanges. Use suitable gaskets to ensure weathertight and airtight seal.
4. All units must have field-supplied filters or accessory filter rack installed in the return-air side of the unit. Recommended sizes for filters are shown in Table 1.
5. Size all ductwork for maximum required airflow (either heating or cooling) for unit being installed. Avoid abrupt duct size increases or decreases or performance may be affected.
6. Adequately insulate and weatherproof all ductwork located outdoors. Insulate ducts passing through unconditioned space, and use vapor barrier in accordance with latest issue of Sheet Metal and Air Conditioning Contractors National Association (SMACNA) and Air Conditioning Contractors of America (ACCA) minimum installation standards for heating and air conditioning systems. Secure all ducts to building structure.
7. Flash, weatherproof, and vibration-isolate all openings in building structure in accordance with local codes and good building practices.

Step 10 — Install Electrical Connections

⚠ WARNING

The unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of an electrical wire connected to the unit ground lug in the control compartment, or conduit approved for electrical ground when installed in accordance with NEC (National Electrical Code) ANSI/NFPA (latest edition) (in Canada, Canadian Electrical Code CSA [Canadian Standards Association] C22.1) and local electrical codes. *Do not use gas piping as an electrical ground.* Failure to adhere to this warning could result in personal injury or death.

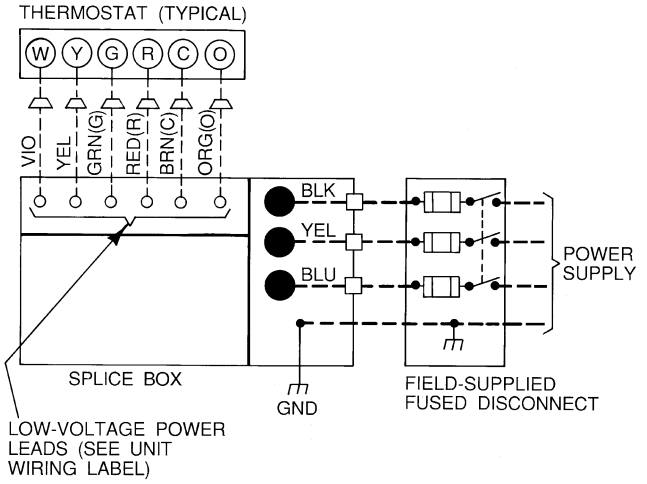
⚠ CAUTION

Failure to follow these precautions could result in damage to the unit being installed:

1. Make all electrical connections in accordance with NEC ANSI/NFPA (latest edition) and local electrical codes governing such wiring. In Canada, all electrical connections must be in accordance with CSA standard C22.1 Canadian Electrical Code Part 1 and applicable local codes. Refer to unit wiring diagram.
2. Use only *copper* conductor for connections between field-supplied electrical disconnect switch and unit. DO NOT USE ALUMINUM WIRE.
3. Be sure that high-voltage power to unit is within operating voltage range indicated on unit rating plate.
4. Do not damage internal components when drilling through any panel to mount electrical hardware, conduit, etc. On 3-phase units, ensure phases are balanced within 2 percent. Consult local power company for correction of improper voltage and/or phase imbalance.

HIGH-VOLTAGE CONNECTIONS (Fig. 17) — The unit must have a separate electrical service with a field-supplied, waterproof, disconnect switch mounted at, or within sight from, the unit. Refer to the unit rating plate for maximum fuse/circuit breaker size and minimum circuit amps (ampacity) for wire sizing. See Table 3 for electrical data.

The field-supplied disconnect switch box may be mounted on the unit over the high-voltage inlet hole when the standard power and low-voltage entry points are used. See Fig. 2-5 for acceptable location.



LEGEND

Field Control-Voltage Wiring
Field High-Voltage Wiring

NOTE: Use blue wire for 3-phase units only.

Fig. 17 — High- and Control-Voltage Connections

Power Entry

1. Remove knockouts in fixed compressor panel located on duct panel side of unit.
2. Route high-voltage leads into high-voltage terminal box.
3. Connect ground wire to green-yellow wire using field-supplied splice.
4. Connect power wires to unit high-voltage leads.
5. On 3-phase units, locate blue wire projecting from compressor junction box. Cut wire at partition and route into high-voltage junction box through grommet in back of junction box.
6. On 3-phase units, strip back blue lead and connect to third leg of the power wires. See Fig. 17.

Table 3 — Electrical Data

UNIT SIZE	V-PH-Hz	VOLTAGE RANGE		COMPRESSOR		OUTDOOR-FAN MOTOR	INDOOR-FAN MOTOR	POWER SUPPLY		AWG 60C MIN WIRE SIZE	MAX WIRE LENGTH (ft)
		Min	Max	RLA	LRA	FLA	FLA	MCA	MOCP*		
030	208/230-1-60	187	253	15.0	73	1.4	2.6	22.8	30	10	100
	208/230-3-60	187	253	10.1	71	1.4	2.8	16.6	25	12	75
036	208/230-1-60	187	253	16.0	88	1.2	2.6	24.4	40	10	90
	208/230-3-60	187	253	10.3	77	1.2	2.6	17.3	25	12	65
	460-3-60	414	506	5.1	39	0.7	1.3	8.7	10	14	100
048	208/230-1-60	187	253	26.4	129	1.4	7.2	41.6	60	6	100
	208/230-3-60	187	253	15.0	99	1.4	7.2	27.4	40	10	70
060	208/230-1-60	187	253	32.1	169	2.1	7.2	49.4	60	6	100
	208/230-3-60	187	253	19.3	123	2.1	7.2	33.4	50	8	100

LEGEND

AWG — American Wire Gage
FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
RLA — Rated Load Amps
UL — Underwriters' Laboratories

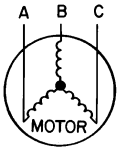
*Fuse or HACR breaker.

NOTES:

1. In compliance with NEC (National Electrical Code) requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. The UL, Canada, units may be fuse or circuit breaker.
2. Minimum wire size is based on 60 C copper wire. If other than 60 C wire is used, or if length exceeds wire length in table, determine size from NEC.
3. **Unbalanced 3-Phase Supply Voltage**
   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percent of voltage imbalance.

$$\% \text{ Voltage imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

EXAMPLE: Supply voltage is 460-3-60.



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3} = \frac{1371}{3} = 457$$

Determine maximum deviation from average voltage.
(AB) 457 − 452 = 5 v
(BC) 464 − 457 = 7 v
(AC) 457 − 455 = 2 v

Maximum deviation is 7 v.

Determine percent of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{7}{457} = 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

SPECIAL PROCEDURES FOR 208-V OPERATION

⚠ WARNING

Make sure that the gas supply *then* the power supply to the unit is switched OFF before making any wiring changes. Electrical shock can cause personal injury or death.

1. Disconnect the red transformer-primary lead from the contactor. See unit wiring label.
2. Remove the wirenut from the terminal on the end of the blue transformer-primary lead.
3. Save the wirenut.
4. Connect the blue lead to the contactor terminal from which the red lead was disconnected.
5. Using the wirenut removed from the blue lead, insulate the loose terminal on the red lead.
6. Wrap the cover with electrical tape so that the metal terminal cannot be seen.

CONTROL VOLTAGE CONNECTIONS — Locate the room thermostat on an inside wall in the space to be conditioned, where it will not be subjected to either a cooling or heating source or direct exposure to sunlight. Mount the thermostat 4 to 5 ft above the floor.

NOTE: Do not use any type of power-stealing thermostat. Unit control problems may result.

Use no. 18 American Wire Gage (AWG) color-coded, insulated (35 C minimum) wires to make the control voltage connections between the thermostat and the unit. If the thermostat is located more than 100 ft from the unit (as measured along the control voltage wires), use no.16 AWG color-coded insulated (35 C minimum) wires.

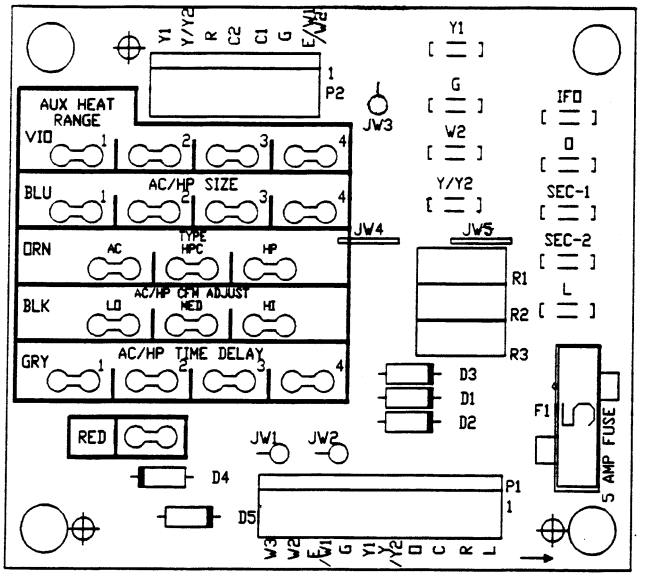
Standard Connection (24 v) — Units Without Integrated Control Motor (Size 030,036) — Remove knockout in compressor fixed panel located below high-voltage knockout. Remove the rubber grommet from the installer's packet (included with unit) and install grommet in the knockout opening. Route thermostat wires through grommet providing drip loop at panel. Connect low-voltage leads as shown in Fig. 17.

Routing Control Power Wires (24 v) — Integrated Control Motor (ICM) Units (Size 048,060) — Remove knockout in compressor fixed access panel located below high-voltage knockout. Remove the rubber grommet from the installer's packet (included with unit) and install grommet in the knockout opening. Route thermostat wires through grommet providing drip loop at panel. Connect low-voltage leads to the thermostat.

The Easy Select interface board is located in the burner section. The Easy Select interface board is factory wired to the motor, and factory default selections are preset. See Fig. 18.

HEAT ANTICIPATOR SETTING — The room thermostat heat anticipator must be properly adjusted to ensure proper heating performance. Set the heat anticipator, using an ammeter between the W and R terminals, to determine the exact required setting.

NOTE: For thermostat selection purposes, use 0.6 amp for the approximate required setting.



LEGEND

IFO — Indoor Fan On
JW — Jumper Wire

Fig. 18 — Easy Select Interface Board

Failure to make a proper heat anticipator adjustment will result in improper operation, discomfort to the occupants of the conditioned space, and inefficient energy utilization; however, the required setting may be changed slightly to provide a greater degree of comfort for a particular installation.

Recommended thermostat and subbase is as follows:

TYPE	THERMOSTAT PART NO.	SUBBASE PART NO.
2-Stage Heat and 1-Stage Cool, Auto, Changeover	HH07AT171	HH93AZ188

TRANSFORMER PROTECTION — The unit transformer protection may be one of 2 types.

The first transformer type may contain an auto. reset overcurrent protector for control circuit protection. If this device trips, it may reset without warning, starting the heating or cooling section of this product. Use caution when servicing; if overcurrent protector continues to trip, there is a problem in the low-voltage electrical circuit, such as an electrical short, ground, or transformer overload. Disconnect power, correct the condition, and check for normal unit operation.

The second transformer type is of the energy-limiting type. It is set to withstand a 30-second overload or shorted secondary condition.

There is also a 5-amp fuse on integrated gas control (IGC) board and Easy Select Interface Board to provide additional overcurrent protection.

PRE-START-UP

⚠ WARNING

Failure to observe the following warnings could result in serious personal injury:

1. Follow recognized safety practices and wear protective goggles when checking or servicing refrigerant system.
2. Do not operate compressor or provide any electric power to unit unless compressor terminal cover is in place and secured.
3. Do not remove compressor terminal cover until all electrical sources are disconnected.
4. Relieve and recover all refrigerant from system before touching or disturbing anything inside terminal box if refrigerant leak is suspected around compressor terminals.
5. Never attempt to repair soldered connection while refrigerant system is under pressure.
6. Do not use torch to remove any component. System contains oil and refrigerant under pressure. To remove a component, wear protective goggles and proceed as follows:
   a. Shut off gas supply and *then* electrical power to unit.
   b. Relieve and recover all refrigerant from system using both high- and low-pressure ports.
   c. Cut component connecting tubing with tubing cutter and remove component from unit.
   d. Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

Proceed as follows to inspect and prepare the unit for initial start-up:

1. Remove all access panels.
2. Read and follow instructions on all WARNING, CAUTION, and INFORMATION labels attached to, or shipped with, unit.
3. Make the following inspections:
   a. Inspect for shipping and handling damages such as broken lines, loose parts, disconnected wires, etc.
   b. Inspect for oil at all refrigerant tubing connections and on unit base. Detecting oil generally indicates a refrigerant leak. Leak-test all refrigerant tubing connections using electronic leak detector, halide torch, or liquid-soap solution. If a refrigerant leak is detected, see Check for Refrigerant Leaks section below.
   c. Inspect all field- and factory-wiring connections. Be sure that connections are completed and tight.
   d. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.
4. Verify the following conditions:

⚠ CAUTION

Do not purge gas supply into the combustion chamber. Do not use a match or other open flame to check for gas leaks. Failure to follow this warning could result in an explosion causing personal injury or death.

   a. Before lighting the unit for the first time, perform the following: If the gas supply pipe was not purged before connecting the unit, it will be full of air. It is recommended that the ground joint union be loosened, and the supply line be allowed to purge until the odor of gas is detected. Never purge gas lines into a combustion chamber. Immediately upon detection of gas odor, retighten the union. Allow 5 minutes to elapse, then light unit.
   b. Make sure that outdoor-fan blade is correctly positioned in fan orifice. Leading edge of outdoor-fan blade should be ½ in. maximum from plastic fan orifice (see Fig. 19).
   c. Make sure that air filter(s) is in place.
   d. Make sure that condensate drain trap is filled with water to ensure proper drainage.
   e. Make sure that all tools and miscellaneous loose parts have been removed.

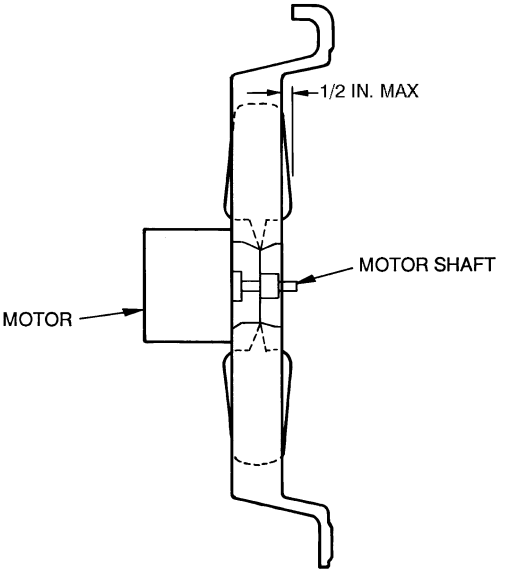


Fig. 19 — Fan Blade Clearance

START-UP

Check for Refrigerant Leaks — Proceed as follows to locate and repair a refrigerant leak and to charge the unit:

1. Locate leak and make sure that refrigerant system pressure has been relieved and reclaimed from both high- and low-pressure ports.
2. Repair leak following accepted practices.

   NOTE: Install a filter drier whenever the system has been opened for repair.
3. Add a small charge of R-22 refrigerant vapor to system and leak-test unit.
4. Evacuate and recover refrigerant from refrigerant system if additional leaks are not found.
5. Charge unit with R-22 refrigerant, using a volumetric-charging cylinder or accurate scale. *Refer to unit rating plate for required charge.* Be sure to add extra refrigerant to compensate for internal volume of filter drier.

Start Up Heating Section and Make Adjustments

⚠ CAUTION

Complete the required procedures given in Pre-Start-Up section on page 15 before starting the unit.

Do not jumper any safety devices when operating the unit.

Make sure that burner orifices are properly aligned. Unstable operation may occur when the burner orifices in the manifold are misaligned.

Follow the lighting instructions on the heating section operation label (located inside the burner or blower access door) to start the heating section.

NOTE: Make sure that gas supply has been purged, and that all gas piping has been checked for leaks.

CHECK HEATING CONTROL — Start and check the unit for proper heating control operation as follows: (See furnace lighting instructions located inside burner or blower access panel.)

1. Place the room thermostat SYSTEM switch in the HEAT position and the fan switch in the AUTO. position.
2. Ensure that OAT (Outdoor-Air Thermostat) capillary is above 55 F. Set the heating temperature control of the thermostat above room temperature only enough to call first-stage heat.
3. Observe compressor, outdoor fan, and indoor fan operate in heat pump mode.
4. Set the heating temperature control of the thermostat enough above room temperature to call second-stage heat.
5. Observe the induced-draft motor start.
6. After a call for second-stage heat, the main burner should light within 5 seconds. If the burners do not light, there is 22-second delay before another 5-second try. If the burners still do not light, this sequence is repeated. If the burners do not light within 15 minutes from the initial call for heat, there is a lockout. To reset the control, break the 24-v power to W.
7. The indoor fan will turn on 45 seconds after the flame has been established. The indoor fan will turn off 45 seconds after the thermostat has been satisfied.

CHECK GAS INPUT — Check gas input and manifold pressure after unit start-up. (See Table 4.) If adjustment is required proceed as follows.

The rated gas inputs shown in Table 4 are for altitudes from sea level to 2000 ft above sea level. These inputs are based on natural gas with a heating value of 1050 Btu/ft^3 at 0.65 specific gravity, or propane gas with a heating value of 2500 Btu/ft^3 at 1.5 specific gravity. For elevations above 2000 ft, reduce input 4% for each 1000 ft above sea level. When the gas supply being used has a different heating value or specific gravity, refer to national and local codes, or contact your distributor to determine the required orifice size.

⚠ CAUTION

These units are designed to consume the rated gas inputs using the fixed orifices at specified manifold pressures as shown in Table 4. DO NOT REDRILL THE ORIFICES UNDER ANY CIRCUMSTANCES.

ADJUST GAS INPUT — The gas input to the unit is determined by measuring the gas flow at the meter or by measuring the manifold pressure. Measuring the gas flow at the meter is recommended for natural gas units. The manifold pressure must be measured to determine the input of propane gas units.

Measure Gas Flow (Natural Gas Units) — Minor adjustment to the gas flow can be made by changing the manifold pressure. The manifold pressure must be maintained between 3.4 and 3.6 in. wg. If larger adjustments are required, change main burner orifices following the recommendations of national and local codes.

NOTE: All other appliances that use the same meter must be turned off when gas flow is measured at the meter.

Proceed as follows:

1. Turn off gas supply to unit.
2. Remove pipe plug on manifold (see Fig. 20), then connect manometer at this point. Turn on gas to unit.
3. Record number of seconds for gas meter test dial to make one revolution.
4. Divide number of seconds in Step 3 into 3600 (number of seconds in one hour).
5. Multiply result of Step 4 by the number of cu ft shown for one revolution of test dial to obtain cu ft of gas flow per hour.
6. Multiply result of Step 5 by Btu heating value of gas to obtain total measured input in Btuh. Compare this value with heating input shown in Table 4. (Consult the local gas supplier if the heating value of gas is not known.)

EXAMPLE: Assume that the size of test dial is 1 cu ft, one revolution takes 50 seconds, and the heating value of the gas is 1050 Btu/ft^3. Proceed as follows:

1. 50 seconds to complete one revolution.
2. 3600 ÷ 50 = 72.
3. 72 x 1 = 72 ft^3 of gas flow/hr.
4. 72 x 1050 = 75,600 Btuh input.

Table 4 — Rated Gas Inputs at Indicated Manifold Pressures

UNIT 48HX	NUMBER OF ORIFICES	GAS SUPPLY PRESSURE (in. wg)				MANIFOLD PRESSURE (in. wg)		NATURAL GAS		PROPANE*	
		Natural		Propane				Orifice Drill Size	Heating Input (Btuh)†	Orifice Drill Size	Heating Input (Btuh)†
		Min	Max	Min	Max	Natural	Propane				
030040	1	4.0	13.0	4.0	13.0	3.5	3.5	32	40,000	41	40,000
030060, 036060	2	4.0	13.0	4.0	13.0	3.5	3.5	41	56,000	46	54,000
036080, 048080, 060080	2	4.0	13.0	4.0	13.0	3.5	3.5	32	80,000	42	80,000
048100, 060100	2	4.0	13.0	4.0	13.0	3.5	3.5	30	95,000	41	95,000

*When a unit is converted to propane, different size orifices must be used. See separate natural-to-propane conversion kit instructions.

†Based on altitudes from sea level to 2000 ft above sea level. For altitudes above 2000 ft, reduce input rating 4% for each additional 1000 ft. In Canada, from 2000 ft above sea level to 4500 ft above sea level, derate the unit 10%.

If the desired gas input is 80,000 Btuh, only a minor change in the manifold pressure is required.

Observe manifold pressure and proceed as follows to adjust gas input:

1. Remove cover screw over regulator adjustment screw on gas valve.
2. Turn regulator adjustment screw clockwise to increase gas input, or turn regulator adjustment screw counterclockwise to decrease input. Manifold pressure must be between 3.4 and 3.6 in. wg.

⚠ WARNING

Unsafe operation of the unit may result if manifold pressure is outside this range. Personal injury or unit damage may result.

3. Replace cover screw cap on gas valve.
4. Turn off gas supply to unit. Remove manometer from pressure tap and replace pipe plug on gas valve. Turn on gas to unit and check for leaks.

Measure Manifold Pressure (Propane Units) — The main burner orifices on a propane gas unit are sized for the unit rated input when the manifold pressure is 3.5 in. wg.

Proceed as follows to adjust gas input on a propane gas unit:

1. Turn off gas to unit.
2. Remove pipe plug on manifold (see Fig. 20), then connect manometer at this point.
3. Turn on gas to unit.
4. Remove cover screw over regulator adjustment screw on gas valve.
5. Adjust regulator adjustment screw for a manifold pressure reading of 3.5 in. wg. Turn adjusting screw clockwise to increase manifold pressure, or turn adjusting screw counterclockwise to decrease manifold pressure.
6. Replace cover screw.
7. Turn off gas to unit. Remove manometer from pressure tap. Replace pipe plug on gas valve, then turn on gas to unit. Check for leaks.

CHECK BURNER FLAME — With burner access panel removed, observe the unit heating operation. Watch the burner flames to see if they are light blue and soft in appearance, and that the flames are approximately the same for each burner. See Fig. 21. Refer to Maintenance section for information on burner removal.

AIRFLOW AND TEMPERATURE RISE — The heating section for each size unit is designed and approved for heating operation within the temperature-rise range stamped on the unit rating plate.

Table 5 shows the approved temperature-rise range for each heating input, and the air delivery cfm at various temperature rises. The heating operation airflow must produce a temperature rise that falls within the approved range.

Refer to Indoor Airflow and Airflow Adjustments section on page 20 to adjust heating airflow when required.

LIMIT SWITCHES — Normally-closed limit switch (LS) completes the control circuit through the thermostat R circuit. Should the leaving-air temperature rise above the maximum allowable temperature, the limit switch opens and the R control circuit ‘‘breaks.’’ Any interruption in the R control

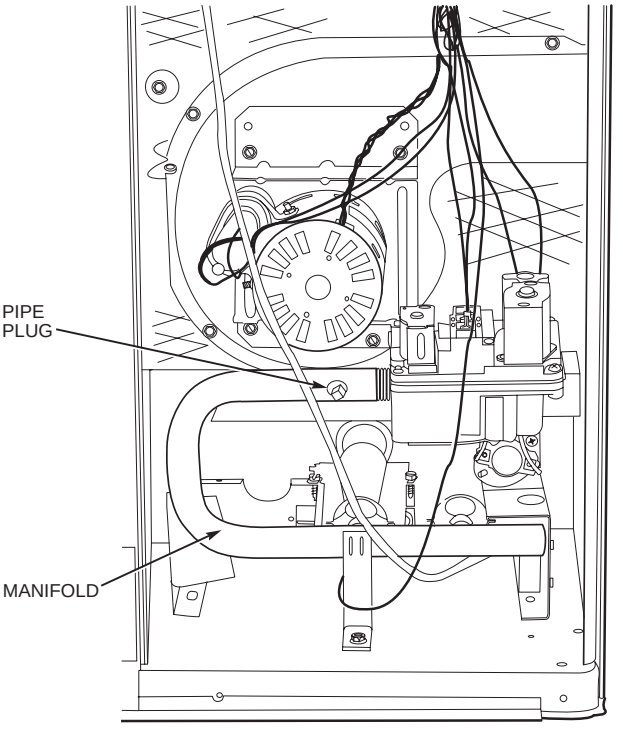


Fig. 20 — Burner Assembly

circuit instantly closes the gas valve and stops gas flow to the burners and pilot. The blower motor continues to run until LS resets.

When the air temperature at the limit switch drops to the low-temperature setting of the limit switch, the switch closes and completes the R control circuit. The electric-spark ignition system cycles and the unit returns to normal heating operation.

AUXILIARY LIMIT SWITCH — ROLLOUT — The function of the switch is to close the main gas valve in the event of flame rollout. The switch is located above the main burners. When the temperature at the auxiliary switch reaches the maximum allowable temperature, the R control circuit trips, closing the gas valve and stopping gas flow to the burners. The indoor fan motor (IFM) and induced draft motor continue to run until switch is reset.

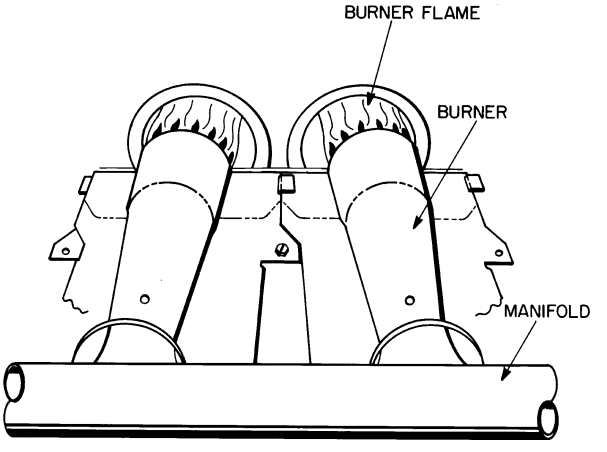


Fig. 21 — Monoport Burners

Table 5 — Air Delivery (Cfm) at Indicated Temperature Rise and Rated Heating Input

HEATING INPUT (Btuh)	TEMPERATURE RISE °F												
	20	25	30	35	40	45	50	55	60	65	70	75	80
40,000	1389	1111	926	794	694	617	556	—	—	—	—	—	—
56,000	1944	1556	1296	1111	972	864	778	707	—	—	—	—	—
80,000	2778	2222	1852	1587	1389	1235	1111	1010	926	855	794	—	—
95,000	3299	2639	2199	1885	1649	1466	1319	1199	1100	1015	942	880	825

NOTE: Dashed areas do not fall within the approved temperature rise range of the unit.

Start Up Cooling Section and Make Adjustments

⚠ CAUTION

Complete the required procedures given in the Pre-Start-Up section on page 15 before starting the unit.

Do not jumper any safety devices when operating the unit.

Do not operate the compressor when the outdoor temperature is below 40 F (unless accessory low-ambient kit is installed).

Do not rapid-cycle the compressor. Allow 5 minutes between ''on'' cycles to prevent compressor damage.

CHECKING COOLING CONTROL OPERATION — Start and check the unit for proper cooling control operation as follows:

1. Place room thermostat SYSTEM switch in OFF position. Observe that blower motor starts when FAN switch is placed in ON position and shuts down when FAN switch is placed in AUTO. position.
2. Place SYSTEM switch in COOL position and FAN switch in AUTO. position. Set cooling control below room temperature. Observe that compressor, outdoor fan, and indoor blower motors start. Observe that cooling cycle shuts down when control setting is satisfied. The indoor fan will continue to run for 30 seconds.
3. When using an auto.-changeover room thermostat, place both SYSTEM and FAN switches in AUTO. positions. Observe that unit operates in Heating mode when temperature control is set to ''call for heating'' (above room temperature) and operates in Cooling mode when temperature control is set to ''call for cooling'' (below room temperature).

IMPORTANT: Three-phase, scroll compressor units are direction-oriented. These units must be checked to ensure proper compressor 3-phase power lead orientation. If not corrected within 5 minutes, the internal protector will shut off the compressor. The 3-phase power leads to the unit must be reversed to correct rotation. When turning backwards, scroll compressors emit elevated noise levels, and the difference between compressor suction and discharge pressures may be dramatically lower than normal.

CHECKING AND ADJUSTING REFRIGERANT CHARGE — The refrigerant system is fully charged with R-22 refrigerant, tested, and factory-sealed.

NOTE: Adjustment of the refrigerant charge is not required unless the unit is suspected of not having the proper R-22 charge.

A superheat charging label is attached to the inside of the compressor access door. The label includes a ''Superheat Charging Table'' and a ''Required Suction-Tube (F) Temperature'' chart.

An accurate superheat, thermocouple-, or thermistor-type thermometer, a sling psychrometer, and a gage manifold are required when using the superheat charging method for evaluating the unit charge. *Do not use mercury or small dial-type thermometers because they are not adequate for this type of measurement.*

⚠ CAUTION

When evaluating the refrigerant charge, an indicated adjustment to the specified factory charge must always be very minimal. If a substantial adjustment is indicated, an abnormal condition exists somewhere in the cooling system, such as insufficient airflow across either coil or both coils.

Proceed as follows:

1. Remove caps from low- and high-pressure service fittings.
2. Using hoses with valve core depressors, attach low- and high-pressure gage hoses to low- and high-pressure service fittings, respectively.
3. Start unit in Cooling mode and let unit run until system pressures stabilize.
4. Measure and record the following:
   a. Outdoor ambient-air temperature (F db).
   b. Indoor inlet-air temperature (F wb).
   c. Suction-tube temperature (F) at low-side service fitting.
   d. Suction (low-side) pressure (psig).
5. Using ''Superheat Charging Table,'' compare outdoor-air temperature (F db) with indoor inlet-air temperature (F wb) to determine desired system operating superheat temperature. See Tables 6A-6D.
6. Using ''Required Suction-Tube Temperature (F)'' table, compare desired superheat temperature with suction (low-side) operating pressure (psig) to determine proper suction-tube temperature. See Table 7.
7. Compare actual suction-tube temperature with proper suction-tube temperature. Using a tolerance of ± 3° F, add refrigerant if actual temperature is more than 3° F higher than proper suction-tube temperature, or remove refrigerant if actual temperature is more than 3° F lower than required suction-tube temperature.

NOTE: If the problem causing the inaccurate readings is a refrigerant leak, refer to Check for Refrigerant Leaks section on page 15.

Table 6A — Superheat Charging Table, 48HX030

TEMP (F) OUTDOOR ENTERING AIR		INDOOR AIR — 1000 CFM											
		Indoor Air — Ewb (F)											
		54	56	58	60	62	64	66	68	70	72	74	76
65	SPH	5.5	5.5	5.5	5.5	12.5	19.6	26.6	26.9	27.2	27.5	26.5	25.4
70	SPH	*	*	*	*	10.5	17.5	24.5	24.8	25.1	25.4	25.1	24.8
75	SPH	*	*	*	*	8.4	15.5	22.5	22.8	23.1	23.4	23.8	24.2
80	SPH	*	*	*	*	6.8	12.9	18.9	20.3	21.5	22.9	23.0	23.0
85	SPH	*	*	*	*	5.1	10.2	15.4	17.7	20.1	22.3	22.1	21.8
90	SPH	*	*	*	*	*	7.9	11.9	15.2	18.5	21.8	21.5	21.2
95	SPH	*	*	*	*	*	5.6	8.4	12.7	17.0	21.2	20.8	20.6
100	SPH	*	*	*	*	*	*	*	9.2	14.1	19.1	19.5	19.9
105	SPH	*	*	*	*	*	*	*	5.7	11.4	17.1	18.2	19.3
110	SPH	*	*	*	*	*	*	*	5.0	10.0	15.1	16.9	18.6
115	SPH	*	*	*	*	*	*	*	*	8.7	13.0	15.5	18.0

LEGEND

Ewb — Entering Wet Bulb
SPH — Superheat at Compressor (F)

*Do not attempt to charge system under these conditions — refrigerant slugging may occur.

Table 6B — Superheat Charging Table, 48HX036

TEMP (F) OUTDOOR ENTERING AIR		INDOOR AIR — 1150 CFM											
		Indoor Air — Ewb (F)											
		54	56	58	60	62	64	66	68	70	72	74	76
65	SPH	28.6	28.6	28.6	30.4	32.1	33.3	34.3	33.4	32.0	30.7	29.8	28.9
70	SPH	23.8	23.8	23.8	25.5	27.2	29.5	32.3	32.0	30.9	29.7	28.6	27.6
75	SPH	19.0	19.0	19.1	20.6	22.2	25.7	30.4	30.6	29.7	28.7	27.5	26.3
80	SPH	14.9	15.0	15.0	15.8	16.5	21.1	26.5	27.7	27.8	27.8	26.6	25.3
85	SPH	10.9	10.9	10.9	10.9	10.9	16.6	22.6	24.8	25.9	26.9	25.6	24.3
90	SPH	7.6	7.7	7.7	7.0	8.3	12.6	19.1	21.5	23.4	25.3	24.4	23.6
95	SPH	*	*	*	*	*	8.6	14.5	16.5	20.9	23.6	23.3	22.9
100	SPH	*	*	*	*	*	*	11.3	14.3	17.4	20.4	21.1	21.8
105	SPH	*	*	*	*	*	*	7.1	10.5	13.9	17.2	19.0	20.8
110	SPH	*	*	*	*	*	*	*	7.1	11.7	16.4	18.2	19.9
115	SPH	*	*	*	*	*	*	*	*	9.6	15.5	17.3	19.1

LEGEND

Ewb — Entering Wet Bulb
SPH — Superheat at Compressor (F)

*Do not attempt to charge system under these conditions — refrigerant slugging may occur.

Table 6C — Superheat Charging Table, 48HX048

TEMP (F) OUTDOOR ENTERING AIR		INDOOR AIR — 1600 CFM											
		Indoor Air — Ewb (F)											
		54	56	58	60	62	64	66	68	70	72	74	76
65	SPH	25.8	26.3	27.0	27.6	28.6	29.6	30.5	30.9	31.3	31.7	31.2	30.7
70	SPH	24.2	24.0	23.8	23.6	25.0	26.4	27.8	28.4	29.0	29.7	29.6	29.5
75	SPH	19.7	19.7	19.7	19.7	21.4	23.2	25.0	25.9	26.8	27.6	27.9	28.2
80	SPH	15.8	15.8	15.8	15.8	17.6	19.4	21.2	22.7	24.1	25.6	26.2	26.9
85	SPH	12.0	12.0	12.0	12.0	13.8	15.6	17.5	19.5	21.5	23.5	24.5	25.6
90	SPH	7.5	7.5	7.5	7.5	9.4	11.3	13.2	16.3	19.3	22.4	23.3	24.2
95	SPH	*	*	*	*	5.0	7.0	9.0	13.1	17.1	21.2	22.0	22.8
100	SPH	*	*	*	*	*	*	*	9.4	14.3	19.1	20.3	21.4
105	SPH	*	*	*	*	*	*	*	5.7	11.4	17.1	18.6	20.1
110	SPH	*	*	*	*	*	*	*	*	9.0	13.5	15.8	18.0
115	SPH	*	*	*	*	*	*	*	*	6.7	10.0	13.0	16.0

LEGEND

Ewb — Entering Wet Bulb
SPH — Superheat at Compressor (F)

*Do not attempt to charge system under these conditions — refrigerant slugging may occur.

Table 6D — Superheat Charging Table, 48HX060

TEMP (F) OUTDOOR ENTERING AIR		INDOOR AIR — 1800 CFM											
		Indoor Air — Ewb (F)											
		54	56	58	60	62	64	66	68	70	72	74	76
65	SPH	21.0	21.0	21.0	21.0	22.8	24.7	26.5	27.8	29.1	30.4	29.5	28.6
70	SPH	16.5	16.5	16.5	16.5	18.8	21.1	23.5	25.2	27.0	28.8	28.2	27.6
75	SPH	12.0	12.0	12.0	12.0	14.8	17.6	20.4	22.7	24.9	27.2	26.9	26.6
80	SPH	10.5	10.5	10.5	10.5	12.7	14.9	17.1	19.8	22.5	25.2	25.4	25.5
85	SPH	9.0	9.0	9.0	9.0	10.6	12.3	13.9	17.0	20.0	23.1	23.8	24.5
90	SPH	4.5	4.5	4.5	4.5	6.5	8.5	10.5	14.3	18.1	21.9	22.7	23.5
95	SPH	*	*	*	*	*	4.8	7.2	11.7	16.2	20.7	21.6	22.5
100	SPH	*	*	*	*	*	*	3.6	8.6	13.6	18.6	20.0	21.4
105	SPH	*	*	*	*	*	*	*	5.5	11.1	16.6	18.5	20.4
110	SPH	*	*	*	*	*	*	*	*	10.0	15.5	17.5	19.4
115	SPH	*	*	*	*	*	*	*	*	9.2	14.7	16.5	18.5

LEGEND

Ewb — Entering Wet Bulb
SPH — Superheat at Compressor (F)

*Do not attempt to charge system under these conditions — refrigerant slugging may occur.

Table 7 — Required Suction-Tube Temperature (F)*

SUPERHEAT TEMP (F)	SUCTION PRESSURE AT SERVICE PORT (psig)								
	61.5	64.2	67.1	70.0	73.0	76.0	79.2	82.4	85.7
0	35	37	39	41	43	45	47	49	51
2	37	39	41	43	45	47	49	51	53
4	39	41	43	45	47	49	51	53	55
6	41	43	45	47	49	51	53	55	57
8	43	45	47	49	51	53	55	57	59
10	45	47	49	51	53	55	57	59	61
12	47	49	51	53	55	57	59	61	63
14	49	51	53	55	57	59	61	63	65
16	51	53	55	57	59	61	63	65	67
18	53	55	57	59	61	63	65	67	69
20	55	57	59	61	63	65	67	69	71
22	57	59	61	63	65	67	69	71	73
24	59	61	63	65	67	69	71	73	75
26	61	63	65	67	69	71	73	75	77
28	63	65	67	69	71	73	75	77	79
30	65	67	69	71	73	75	77	79	81
32	67	69	71	73	75	77	79	81	83
34	69	71	73	75	77	79	81	83	85
36	71	73	75	77	79	81	83	85	87
38	73	75	77	79	81	83	85	87	89
40	75	77	79	81	83	85	87	89	91

*Temperature at suction service valve.

INDOOR AIRFLOW AND AIRFLOW ADJUSTMENTS

⚠ CAUTION

For cooling operation, the recommended airflow is 350 to 450 cfm for each 12,000 Btuh of rated cooling capacity. For heating operation, the airflow must produce a temperature rise that falls within the range stamped on the unit rating plate.

Table 5 shows the temperature rise at various airflow rates.

Size 030 and 036 — Table 8 shows both heating and cooling airflows at various external static pressures for unit sizes 030 and 036. Refer to this table to determine the airflow for the system being installed. See Table 9 for wet coil pressure drop.

NOTE: Be sure that all supply- and return-air grilles are open, free from obstructions, and adjusted properly.

⚠ WARNING

Shut off gas supply *then* disconnect electrical power to the unit before changing blower speed. Electrical shock can cause personal injury or death.

Airflow can be changed by changing the lead connections of the blower motor.

Unit 48HX030 is factory wired for medium speed; unit 48HX036 3-speed motors are factory wired for low speed.

Table 8 — Dry-Coil Air Delivery* — Horizontal and Downflow Discharge at 230 and 460 V — Size 030,036 (Deduct 10% from Cfm and Watts for 208 V Operation)

UNIT 48HX	MOTOR SPEED	AIR DELIVERY	EXTERNAL STATIC PRESSURE (in. wg)										
			0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
030	Low	Watts	280	275	265	255	250	245	240	†	†	†	†
		Cfm	820	810	755	700	660	600	560	†	†	†	†
	Med	Watts	365	360	350	345	340	330	320	310	300	†	†
		Cfm	1025	1010	975	940	900	850	800	720	630	†	†
	High	Watts	†	†	490	480	470	460	445	430	410	390	380
		Cfm	†	†	1300	1255	1200	1150	1080	1005	915	790	620
036	Low	Watts	420	395	385	370	360	350	†	†	†	†	†
		Cfm	1265	1220	1170	1125	1065	1005	†	†	†	†	†
	Med	Watts	545	525	500	480	460	445	425	405	355	†	†
		Cfm	1550	1485	1420	1355	1280	1210	1125	1035	910	†	†
	High	Watts	†	†	†	†	615	585	560	535	505	465	†
		Cfm	†	†	†	†	1565	1460	1350	1230	1100	905	†

*Air delivery values are without air filter and are for dry coil. See Table 9 for wet coil pressure drop. Deduct field-supplied air filter pressure drop and wet coil pressure drop to obtain external static pressure available for ducting.
†Unit air delivery is outside of operating range.

NOTE: Do not operate the unit at a cooling airflow that is less than 350 cfm for each 12,000 Btuh of rated cooling capacity. Indoor-coil icing may occur at airflows below this point. Water blow-off may occur at airflows above 450 cfm per 12,000 Btuh of rated cooling capacity.

For 208/230-v and A.O. Smith 460-v Blower Motors — The motor leads are color-coded as follows:

3-SPEED
black = high speed
blue = medium speed
red = low speed

To change the speed of the blower motor, remove the fan motor speed leg lead from the blower relay (BR). This wire is attached to terminal BM for single-phase and 3-phase units. To change the speed, remove and replace with lead for desired blower motor speed. *Insulate the removed lead to avoid contact with chassis parts.*

For 460-v GE Motors — The motor leads are color-coded as follows:

3-SPEED
black = high speed
blue = jumper
orange = medium
red = low speed

To change the speed of the blower motor, remove fan motor speed lead from the blower relay (BR) and replace with the lead for the desired blower motor speed. The motor speed lead is attached to terminal BM. *Insulate removed lead end to avoid contact with chassis parts.* Connect orange lead to terminal BM of BR. To select high speed on 460-v GE motors, separate the black (female QC) from the blue lead (male QC) and connect the black lead to the BR. *Insulate the blue lead to avoid contact with any chassis parts.*

Size 048 and 060 — These units have an integrated control motor (ICM). To configure the unit, move the 5 Easy Select board wires to the terminals which control the airflow. Refer to the Easy Select interface board (Fig. 18) located next to the terminals and wiring diagrams for sizes 048 and 060 in back of book.

Perform the following steps for basic system configuration.

AUX HEAT RANGE (VIO) — The airflow for unit is preset at the factory. The airflow selection must not be set at a setting lower than the default. Refer to Table 10 for airflow and gas heat input for terminals 1-4.

AC/HP SIZE (BLU) — The preset factory default selection for AC/HP SIZE (air conditioner/heat pump) is set to terminal 3 for size 048 and terminal 4 for size 060. See Table 11 for airflows supplied at terminals. See Table 12 for air delivery in FAN ONLY mode.

Table 9 — Wet Coil Pressure Drop

UNIT SIZE 48HX	AIRFLOW (cfm)	PRESSURE DROP (in. wg)
030	800	0.025
	900	0.039
	1000	0.057
	1200	0.072
036	1000	0.051
	1200	0.061
	1400	0.068
	1600	0.075
048	1400	0.068
	1600	0.075
	1800	0.088
060	1700	0.082
	1900	0.095
	2100	0.108
	2300	0.123

Table 10 — Dry Coil Air Delivery* — Gas Heating; Sizes 048,060; Horizontal and Vertical Discharge for Integrated Control Motor Units at 230-V (Deduct 10% from Cfm for 208-V Operation)

HEATING INPUT (Btuh)	EASY SELECT BOARD TERMINALS			
	1	2	3	4
	Airflow (Cfm)			
80,000	1300	1400	1600	1750
100,000	—	1400	1600	1750

*Air delivery values are for dry coil at 230 v. Airflow is independent of external static pressure within ± 5% of table values up to 0.8 in. wg.

NOTES:
1. Dashed area does not fall within approved range.
2. The above values occur with the AC/HP CFM ADJUST select jumper on the Easy Select interface board set on MED.
3. Airflow can be adjusted +10% or −10% by selecting HI or LO for all modes except FAN ONLY.

Table 11 — Dry-Coil Air Delivery* Cooling and Heat Pump Heating; Sizes 048,060; Horizontal and Vertical Discharge for Integrated Control Motor Units at 230-V (Deduct 10% from Cfm for 208-V Operation)

UNIT SIZE 48HX	EASY SELECT BOARD TERMINALS			
	1	2	3	4
	Airflow (Cfm)			
048,060 Cooling Mode 048 Heating Mode	1260	1440	1575	1800
060 Heating Mode	1400	1600	1750	2000

*Air delivery values are for dry coil at 230 v. Airflow is independent of external static pressure within ±5% of table values up to 0.8 in wg.

NOTE: Do not operate the unit at a cooling airflow that is less than 350 cfm for each 12,000 Btuh of rated cooling capacity. Indoor-coil icing may occur at airflows below this point. Water blow-off may occur at airflows above 450 cfm per 12,000 Btuh of rated cooling capacity.

Table 12 — Dry Coil Air Delivery* Fan Only; Sizes 048,060; Horizontal and Vertical Discharge for Integrated Control Motor Units at 230-V (Deduct 10% from Cfm for 208-V Operation)

UNIT SIZE 48HX	FAN ONLY AIRFLOW (Cfm)
048	1400
060	1750

*Air delivery values are for dry coil at 230 V. Airflow is independent of external static pressure within ±5% of table values up to 0.8 in. wg.

TYPE (ORN) — The TYPE is a preset factory default selection. The preset factory default setting is HPC for size 048 and HP for size 060. Default setting should not be altered.

AC/HP CFM ADJUST (BLK) — The preset factory default selection is MED. Selections HI and LO will adjust the airflow supplied for all operational modes (see table below). The selection options allow installer to adjust airflow to meet such individual needs as noise and static compensation, etc.

MODE	FAN ONLY	COOLING	HEATING
LO — Adjust	−15%	−10%	−10%
HI — Adjust	15%	10%	10%

OUTDOOR-AIR THERMOSTAT — The outdoor-air thermostat (OAT) is a field-adjustable control that controls the temperature at which the 48HX unit changes from heat pump operation to gas burner operation in first-stage heating. It adjusts temperatures from 0° to 52 F. (Second-stage heating is always gas-fired heat.)

As outdoor temperatures decrease, the efficiency of heat pumps decrease and a point is reached where gas heat becomes more economical than the heat pump. This point is known as the economic balance point (EBP). At outdoor air temperatures above the EBP, the 48HX unit operates the heat pump on a call for first-stage heat and operates the gas burners on a call for second-stage heat. At temperatures below the EBP, the OAT locks out the heat pump and operates the gas burners for both the first- and second-stage heat.

The EBP is dependent on local utility rates. If the local cost of electricity is high or the local cost of gas is low, it is cost effective to switch to gas-fired heating at a warmer outdoor temperature.

Conversely, if the local cost of electricity is low or the local cost of gas is high, it is cost effective to switch to gas-fired heating at a colder outdoor temperature.

The OAT must be field set based on the local EBP. To determine the EBP, first find the cost of gas on a $/Therm basis and the cost of electricity on a $/kW basis. Refer to Fig. 22, 48HX Economic Balance Point. On the horizontal axis plot the cost of electricity and draw a vertical line from this point. On the vertical axis plot the cost of gas and draw a horizontal line until it intersects the vertical line. This intersection is the economic balance point and can be read directly by determining where the intersection falls in the set of curves. This value will be in degrees Fahrenheit.

Once this value has been determined, the outdoor-air thermostat can be set to provide for the most economical operation.

EXAMPLE:

Cost of Electricity	$ 0.1/kW
Cost of Gas	$ 0.9/Therm

From Economic Balance Point Chart, Fig. 22, read that the EBP is 30 F.

The EBP differs from the thermal balance point. The thermal balance point is the outdoor temperature below which the heat pump can no longer satisfy the heating requirements of the building. The thermal balance point is determined by the thermal loss of the building and the size of the heat pump. Unlike the EBP, no adjustment is necessary based on the thermal balance point; the thermostat simply calls for first-stage heat or second-stage heat as necessary.

To Set OAT — The OAT is located in the control box beneath the mounting bracket and is factory set at 40 F. Turn knob on the OAT to the temperature that is equal to the EBP. Refer to Fig. 22 and determine EBP as described previously. Uncoil the OAT capillary and run it outside the unit to sense outdoor temperature. The capillary may be supported by any object outside the unit that does not get warm (such as the incoming gas line) but must not rest on the unit itself. If the outdoor air temperature is below the OAT setting, the cooling mode is locked out.

Sequence of Operation

HEATING SEQUENCE OF OPERATION — See wiring diagrams in back of book and unit wiring label.

On a call for heat, one of 2 Heating modes occurs, depending on the field setting of the economic balance point.

The first Heating mode occurs when the outdoor temperature is warmer than the EBP. On a call for heat, the thermostat makes circuits R-Y and R-G. When compressor time delay (5 ± 2 minutes) is completed, a circuit is made to C, starting compressor (COMP) and outdoor-fan motor (OFM). Circuit R-G also is completed, energizing indoor-fan relay (IFR) and starting indoor-fan motor (IFM) after a 1-second delay. Should room temperature continue to fall, circuit R-W is made through second-stage thermostat bulb. One relay opens, turning off the compressor, and another relay is energized signaling the integrated gas control (IGC) board to bring on the gas heat. When the thermostat is satisfied, contacts open, deenergizing contactor and relay; motors and gas heater deenergize. The IFM may be controlled by a time-delay relay that keeps the fan on for 30 seconds.

The second Heating mode occurs when the outdoor temperature is colder than the EBP. On a call for heat, the thermostat energizes the gas heat relay, signaling the IGC board to bring on the gas heat. In this Heating mode, both first- and second-stage heat is gas heating. When thermostat is

satisfied, contacts open, deenergizing contactor and relay; motors and gas heater deenergize. The IFM may be controlled by a time-delay relay that keeps the fan on for 30 seconds.

An LED (light-emitting diode) indicator is provided on the control board to monitor operation. The control board is located by removing the burner access panel. During normal operation, the LED is continuously on. See Table 13 for error codes.

See Fig. 23 for typical heat pump operation, heating mode.

Table 13 — LED Indications

ERROR CODE	LED INDICATION
Normal Operation	On
Hardware Failure	Off
Fan On/Off Delay Modified	1 Flash
Limit Switch Fault	2 Flashes
Flame Sense Fault	3 Flashes
Four Consecutive Limit Switch Faults	4 Flashes
Ignition Lockout Fault	5 Flashes
Induced-Draft Motor Point	6 Flashes
Rollout Switch Fault	7 Flashes
Internal Control fault	8 Flashes

NOTES:
1. There is a 3-second pause between error code displays.
2. If more than one error code exists, all applicable error codes will be displayed in numerical sequence.
3. This chart is on the wiring diagram located inside the burner access panel.

COOLING SEQUENCE OF OPERATION — When the room temperature rises to a point that is slightly above the cooling control setting of the thermostat, the thermostat completes the circuit between thermostat terminal R to terminals Y and G. These completed circuits through the thermostat connect contactor coil (C) (through unit wire Y) and blower relay coil (BR) (through unit wire G) across the 24-v secondary of transformer (TRAN).

NOTE: The blower relay coil (BR) is used on non-ICM units; ICM units use evaporator (indoor) fan on (IFO) connection.

The normally-open contacts of energized contactor (C) close and complete the circuit through compressor motor (COMP) to outdoor-fan motor (OFM). Both motors start instantly.

On non-ICM units, the set of normally-open contacts of energized relay BR closes and completes the circuit through blower (indoor) fan motor (IFM). On ICM units, the IFO completes the circuit through IFM. The blower motor starts instantly.

NOTE: Once the compressor has started and then has stopped, it should not be started again until 5 minutes have elapsed.

The cooling cycle remains ‘‘on’’ until the room temperature drops to point that is slightly below the cooling control setting of the room thermostat. At this point, the thermostat ‘‘breaks’’ the circuit between thermostat terminal R to terminals Y and G. These open circuits deenergize contactor coil C and relay coil BR. The OFM and compressor motor stop. After a 30-second delay, the IFM stops. The unit is in a standby condition, waiting for the next call for cooling from the room thermostat.

See Fig. 24 for typical heat pump operation, cooling mode.

DEFROST — Defrost board (DB) is a time and temperature control, which includes a field-selectable time period between checks for defrost (30, 50, and 90 minutes). Electronic timer and defrost cycle start only when contactor is energized and defrost thermostat (DFT) is closed.

Defrost mode is identical to Cooling mode, except outdoor-fan motor stops and gas heat turns on to warm air supplying the conditioned space. Once the gas heat has been energized, it is locked in for a minimum of 1 minute.

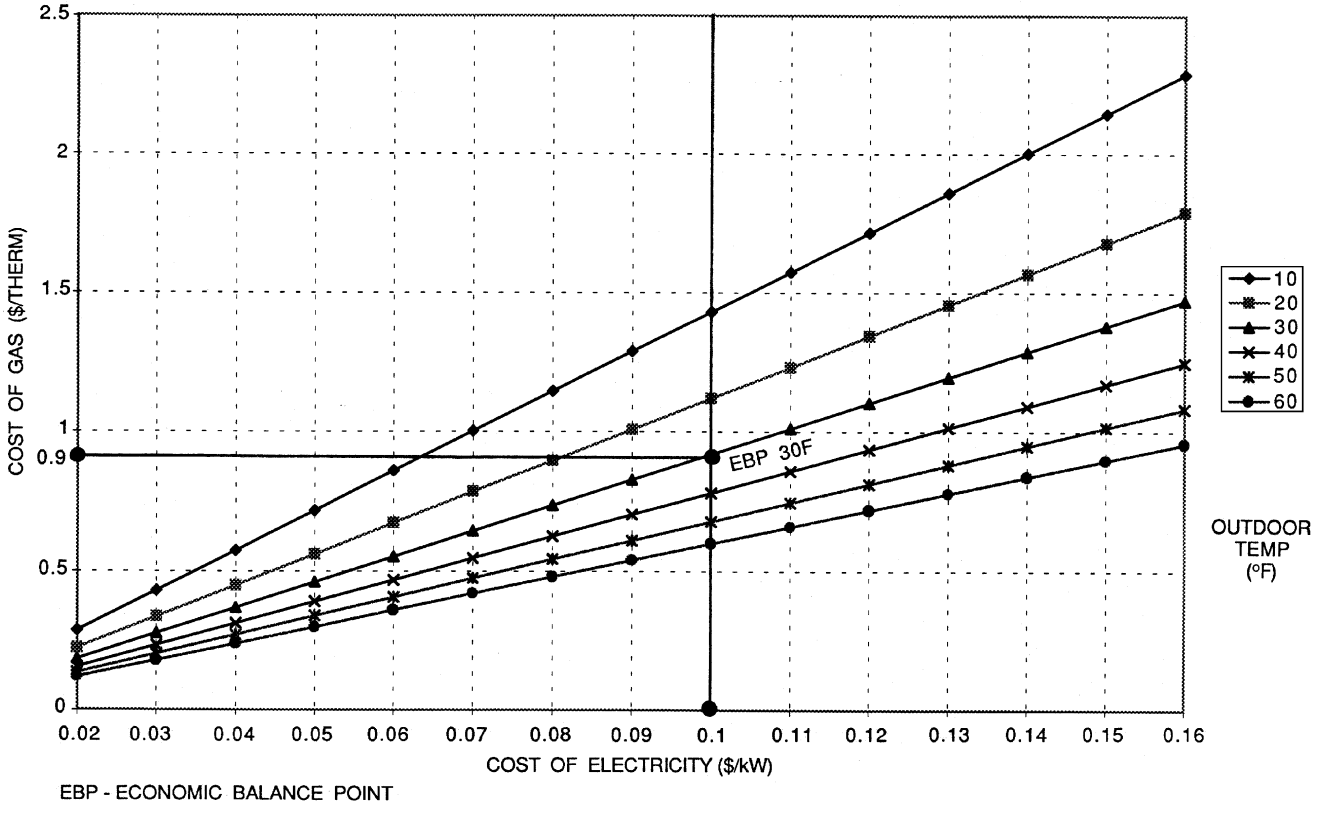
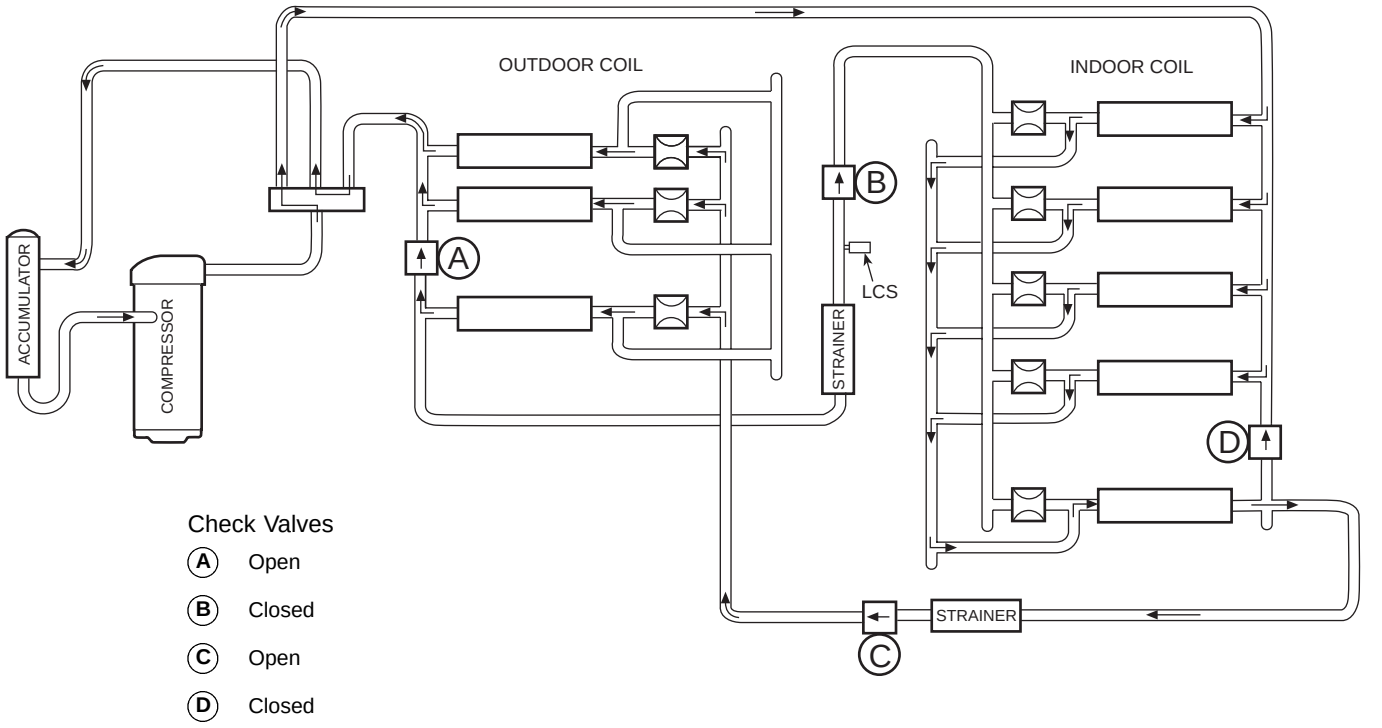


Fig. 22 — 48HX Economic Balance Point



LEGEND

LCS — Loss of Charge Switch

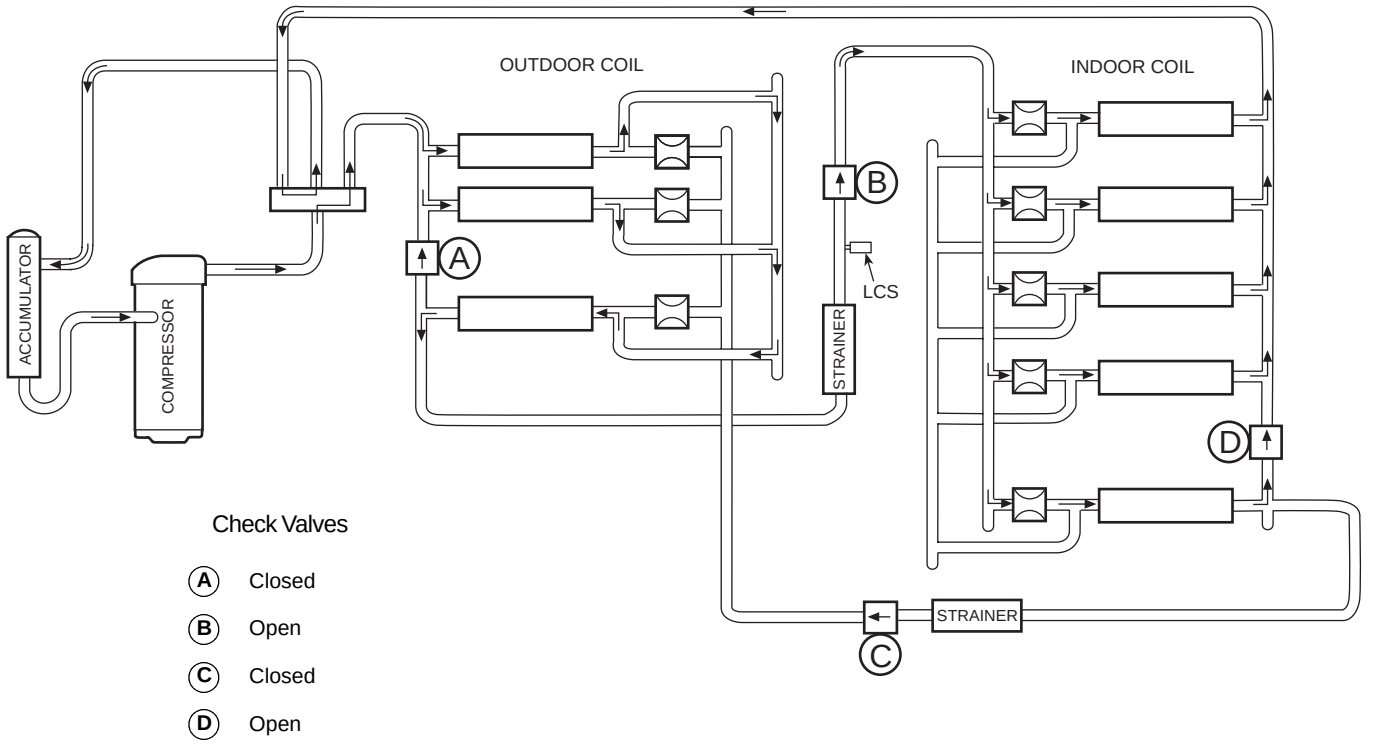
Acutrol™ Metering Device

Check Valve (Arrow indicates direction of flow)

HEATING CYCLE

1. Hot gas from compressor flows through the 4-way valve and is directed to the cooling liquid line check valve. It is then condensed and directed through subcooling circuits and out to the strainer and the check valve in the heating liquid line.
2. The refrigerant then feeds the outdoor coil through the Acutrol metering device on each circuit.
3. Each circuit evaporates the refrigerant and the circuits are combined in the outdoor header with some of the circuits flowing through the check valve.
4. The refrigerant then flows through the 4-way valve, accumulator, and back to the compressor.

Fig. 23 — Typical Heat Pump Operation, Heating Mode



LEGEND

LCS — Loss of Charge Switch

Acutrol™ Metering Device

Check Valve (Arrow indicates direction of flow)

COOLING CYCLE

1. Hot gas from compressor flows through the 4-way valve and is directed to the heating liquid line check valve. It is then condensed and subcooled through converging circuits. Refrigerant leaves the outdoor coil by way of the strainer and the check valve in the cooling liquid line.
2. The refrigerant then feeds the indoor coil through the Acutrol metering device on each circuit.
3. Each circuit evaporates the refrigerant and the circuits are combined in the indoor coil header with some of the circuits flowing through the check valve.
4. The refrigerant then flows through the 4-way valve, accumulator, and back to the compressor.

Fig. 24 — Typical Heat Pump Operation, Cooling Mode

MAINTENANCE

To ensure continuing high performance, and to minimize the possibility of premature equipment failure, periodic maintenance must be performed on this equipment. This dual fuel heat pump should be inspected at least once each year by a qualified service person. To troubleshoot heating or cooling of units, refer to Troubleshooting tables at the back of the book.

NOTE TO EQUIPMENT OWNER: Consult your local dealer about the availability of a maintenance contract.

⚠ WARNING

The ability to properly perform maintenance on this equipment requires certain expertise, mechanical skills, tools, and equipment. If you do not possess these, do not attempt to perform any maintenance on this equipment other than those procedures recommended in the User's Manual. FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS PERSONAL INJURY AND POSSIBLE DAMAGE TO THIS EQUIPMENT.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect air filter(s) each month. Clean or replace when necessary.
2. Inspect indoor coil, drain pan, and condensate drain each cooling season for cleanliness. Clean when necessary.
3. Inspect blower motor and wheel for cleanliness and check lubrication each heating and cooling season. Clean and lubricate (if required) when necessary. For first heating season, inspect blower wheel bimonthly to determine proper cleaning frequency.
4. Check electrical connections for tightness and controls for proper operation each heating and cooling season. Service when necessary.
5. Check and inspect heating section before each heating season. Clean and adjust when necessary.
6. Check flue hood screen and remove any obstructions if necessary.
7. Check vent screen and clean if necessary.

⚠ WARNING

Failure to follow these warnings could result in serious personal injury:

1. Turn off gas supply, *then* turn off electrical power to the unit before performing any maintenance or service on the unit.
2. Use extreme caution when removing panels and parts. As with any mechanical equipment, personal injury can result from sharp edges, etc.
3. Never place anything combustible either on, or in contact with, the unit.
4. Should overheating occur, or the gas supply fail to shut off, shut off the external main manual gas valve to the unit, *then* shut off the electrical supply.

Air Filter

⚠ CAUTION

Never operate the unit without a suitable air filter in the return-air duct system. Always replace the filter with the same dimensional size and type as originally installed. See Table 1 for recommended filter sizes.

Inspect air filter(s) at least once each month and replace (throwaway-type) or clean (cleanable-type) at least twice during each heating and cooling season or whenever the filter(s) becomes clogged with dust and lint.

Unit Top Removal

NOTE: When performing maintenance or service procedures that require removal of the unit top, be sure to perform *all* of the routine maintenance procedures that require top removal, including: inspection of the heat exchanger area, coil inspection and cleaning, and condensate drain pan inspection and cleaning.

Only qualified service personnel should perform maintenance and service procedures that require unit top removal. Refer to the following top removal procedures:

1. Turn off gas supply, *then* turn off electric power to unit.
2. Remove all screws that secure unit top, including screws around 4 sides and those on top that screw into internal divider panels. Save all screws.
3. Lift top from unit carefully. Set top on edge.
4. Carefully replace and secure unit top to unit, using screws removed in Step 2, when maintenance and/or service procedures are completed. (Be sure to use original screws that have rubber washers to seal out water when securing top to internal divider panels.)

Indoor Blower and Motor

NOTE: Motors without oilers are prelubricated. Do not attempt to lubricate these motors.

For longer life, operating economy, and continuing efficiency, clean accumulated dirt and grease from the blower wheel and motor annually.

Lubricate the motor every 5 years if the motor is used intermittently (thermostat FAN switch in AUTO. position), or every 2 years if the motor is used continuously (thermostat FAN switch in ON position).

⚠ WARNING

Turn off the gas supply, *then* disconnect and tag electrical power to the unit before cleaning and lubricating the blower motor and wheel. Failure to adhere to this warning could cause personal injury or death.

To clean and lubricate the blower motor and wheel for direct-drive models:

1. Remove and disassemble blower assembly as follows:
   a. Remove blower access door.
   b. On units without ICM, disconnect motor lead from blower relay (BR). Disconnect yellow lead from terminal L2 of the contactor.
   c. On all units remove blower assembly from unit. Remove screws securing blower to gas partition and slide assembly out. Be careful not to tear insulation in blower compartment.
   d. Ensure proper reassembly by marking blower wheel and motor in relation to blower housing before disassembly.
   e. Loosen setscrew(s) that secures wheel to motor shaft, remove screws that secure motor mount brackets to housing, and slide motor and motor mount out of housing.
2. Lubricate motor as follows:
   a. Thoroughly clean all accumulations of dirt or grease from motor housing.
   b. Remove dust caps or plugs from oil ports located at each end of motor.

c. Use a good grade of SAE (Society of Automotive Engineers) 20 nondetergent motor oil and put one teaspoon (3⁄16 oz. or 16 to 25 drops) in each oil port.

d. Allow time for oil to be absorbed by each bearing, then wipe excess oil from motor housing.

e. Replace dust caps or plugs in oil ports.

3. Remove and clean blower wheel as follows:
   a. Ensure proper reassembly by marking wheel orientation.
   b. Lift wheel from housing. When handling and/or cleaning blower wheel, be sure not to disturb balance weights (clips) on blower wheel vanes.
   c. Remove caked-on dirt from wheel and housing with a brush. Remove lint and/or dirt accumulations from wheel and housing with vacuum cleaner, using soft brush attachment. Remove grease and oil with mild solvent.
   d. Reassemble wheel into housing.
   e. Reassemble motor into housing. Be sure setscrews are tightened on motor shaft flats and not on round part of shaft.
   f. Reinstall blower access door.
4. Restore electrical power, then gas supply to unit. Start unit and check for proper blower rotation and motor speeds during heating and cooling cycles.

Flue Gas Passageways — To inspect the flue collector box and upper areas of the heat exchanger:

1. Remove the combustion blower wheel and motor assembly according to directions in Combustion-Air Blower section below.
2. Remove the 3 screws holding the blower housing to the flue collector box cover (see Fig. 25).
3. Remove the 12 screws holding the flue collector box cover (Fig. 25) to the heat exchanger assembly. Inspect the heat exchangers.
4. Clean all surfaces as required using the wire brush.

Combustion-Air Blower — Clean periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically during heating season. For the first heating season, inspect blower wheel bimonthly to determine proper cleaning frequency.

To inspect blower wheel, remove draft hood assembly. Shine a flashlight into opening to inspect wheel. If cleaning is required, remove motor and wheel as follows:

1. Remove burner access panel. (See Fig. 26.)
2. Remove the 7 screws that attach induced-draft motor mounting plate to blower housing. (See Fig. 25.)
3. Slide the motor and blower wheel assembly out of the blower housing. (See Fig. 27.) Clean the blower wheel. If additional cleaning is required, continue with Steps 4 and 5.
4. To remove blower, remove 2 setscrews. (See Fig. 27.)
5. To remove motor, remove 4 screws that hold blower housing to mounting plate. Remove the motor cooling fan by removing one setscrew. Remove nuts that hold motor to mounting plate.
6. To reinstall, reverse the procedure outlined above.

Limit Switch — Remove blower panel. Limit switch is located on the gas partition.

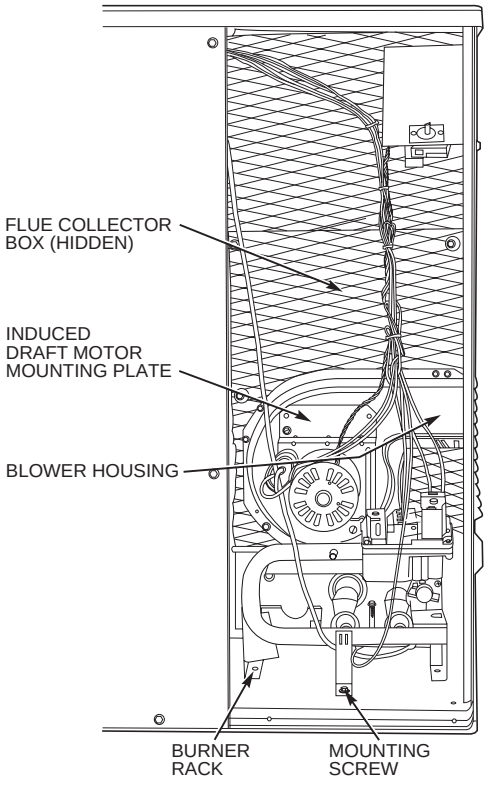


Fig. 25 — Blower Housing and Flue Collector Box

Burner Ignition — Unit is equipped with a direct spark ignition 100% lockout system. Ignition module is located in the control box. Module contains a self-diagnostic LED. During servicing, refer to Table 13 for LED interpretation.

If lockout occurs, unit may be reset by either momentarily interrupting power supply to unit, or turning selector switch to OFF position at the thermostat.

Main Burners — At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames and adjust if necessary.

⚠ CAUTION

When servicing gas train, do not hit or plug orifice spuds.

REMOVAL OF GAS TRAIN

1. Shut off manual gas valve.
2. Shut off power to unit
3. Remove burner access panel. (See Fig. 26.)
4. Disconnect gas piping at unit gas valve.
5. Remove wires connected to gas valve. Mark each wire.
6. Remove ignitor and sensor wires at the ignitor module.
7. Remove the mounting screw that attaches the burner rack to the basepan. (See Fig. 25.)
8. Slide the burner rack out of the unit. (See Fig. 25 and 28.)
9. To reinstall, reverse the procedure outlined above.

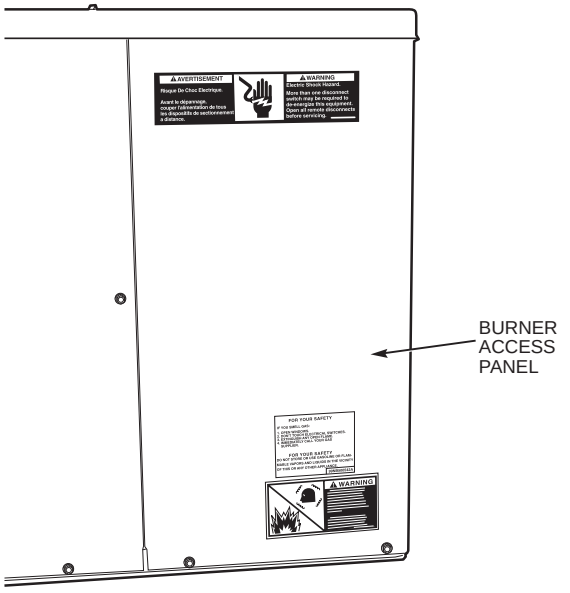


Fig. 26 — Burner Access Panel

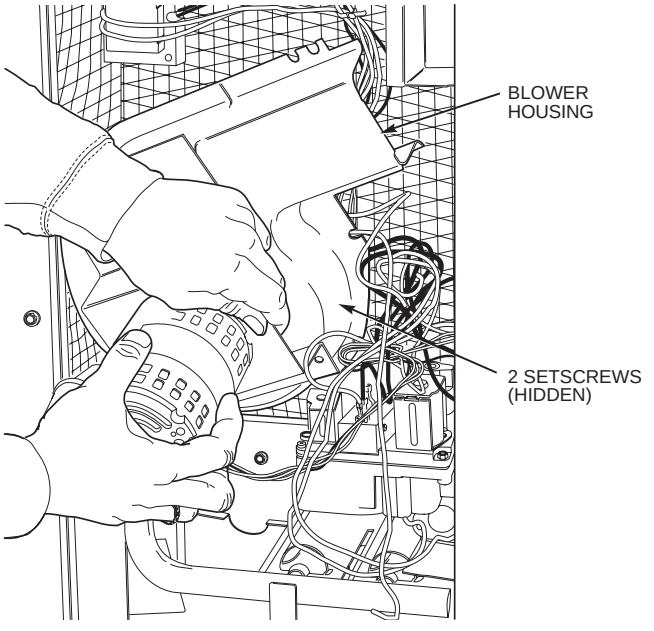


Fig. 27 — Removal of Motor and Blower Wheel

Outdoor Coil, Indoor Coil, and Condensate Drain Pan — Inspect the outdoor coil, indoor coil, and condensate drain pan at least once each year. Proper inspection and cleaning requires the removal of the unit top. See Unit Top Removal section on page 26.

The coils are easily cleaned when dry; therefore, inspect and clean the coils either before or after each cooling season. Remove all obstructions, including weeds and shrubs, that interfere with the airflow through the outdoor coil. Straighten bent fins with a fin comb. If coated with dirt or lint, clean the coils with a vacuum cleaner, using the soft brush attachment. Be careful not to bend the fins. If coated with oil or grease, clean the coils with a mild detergent-and-water solution. Rinse coils with clear water, using a garden hose. Be careful not to splash water on motors, insulation, wiring, or air filter(s). For best results, spray outdoor coil fins from inside to outside the unit. Be sure to clean between outer and inner sections of outdoor coil. Be sure to flush all dirt and debris from the unit base.

Inspect the drain pan and condensate drain line when inspecting the coils. Clean the drain pan and condensate drain by removing all foreign matter from the pan. Flush the pan and drain tube with clear water. Do not splash water on the insulation, motor, wiring, or air filter(s). If the drain tube is restricted, clear it with a ''plumbers snake'' or similar probe device. Ensure that the auxiliary drain port above the drain tube is also clear.

Outdoor Fan

⚠ CAUTION

Keep the outdoor fan free from all obstructions to ensure proper cooling operation. Never place articles on top of the unit. Damage to unit may result.

1. Remove 2 screws at bottom and 2 screws along sides of condenser air intake grille and remove plastic grille.
2. Inspect the fan blades for cracks or bends.
3. If fan needs to be removed, loosen the setscrew and slide the fan off the motor shaft.
4. When replacing fan blade, position blade so that leading edge is ½ in. in front of fan orifice. See Fig. 19.
5. Ensure that setscrew engages the flat area on the motor shaft when tightening.
6. Replace grille.

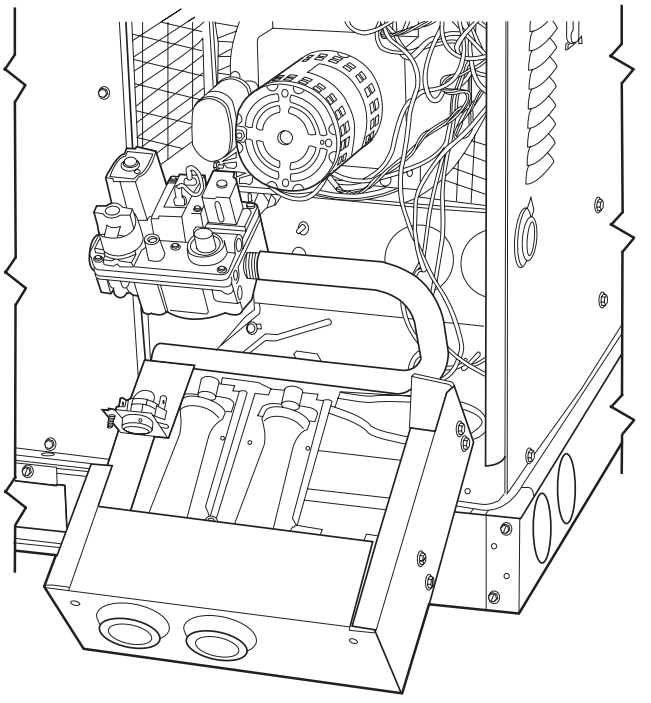


Fig. 28 — Burner Rack Removed

Electrical Controls and Wiring — Inspect and check the electrical controls and wiring annually. *Be sure to turn off the gas supply, and then the electrical power to the unit.*

Remove the control, blower, and compressor compartment access panels to locate all the electrical controls and wiring. Check all electrical connections for tightness. Tighten all screw connections. If any smoky or burned connections are noticed, disassemble the connection, clean all the parts, restrip the wire end and reassemble the connection properly and securely.

After inspecting the electrical controls and wiring, replace all the panels. Start the unit, and observe at least one complete heating cycle and one complete cooling cycle to ensure proper operation. If discrepancies are observed in either or both operating cycles, or if a suspected malfunction has occurred, check each electrical component with the proper electrical instrumentation. Refer to the unit wiring label when making these checkouts.

NOTE: Refer to the heating and/or cooling sequence of operation in this publication as an aid in determining proper control operation.

Refrigerant Circuit — Inspect all refrigerant tubing connections and the unit base for oil accumulations annually. Detecting oil generally indicates a refrigerant leak.

If oil is detected or if low cooling performance is suspected, leak-test all refrigerant tubing using an electronic leak-detector, halide torch, or liquid-soap solution. If a refrigerant leak is detected, refer to Check for Refrigerant Leaks section on page 15.

If no refrigerant leaks are found and low cooling performance is suspected, refer to Checking and Adjusting Refrigerant Charge section on page 18.

Gas Input — The gas input does not require checking unless improper heating performance is suspected. If a problem exists, refer to Start-Up section on page 15.

Indoor Airflow — The heating and/or cooling airflow does not require checking unless improper performance is suspected. *If a problem exists, be sure that all supply- and return-air grilles are open and free from obstructions, and that the air filter is clean.* When necessary, refer to Indoor Airflow and Airflow Adjustments section on page 20 to check the system airflow.

Metering Device — Acutrol™ Device — This metering device is a fixed orifice and is located in the header to the indoor and outdoor coils.

Liquid Line Strainer — The liquid line strainer (to protect metering device) is made of wire mesh and located in the liquid line on the inlet side of the metering device.

TROUBLESHOOTING

Cooling and Heating

SYMPTOM	CAUSE	REMEDY
Compressor and outdoor fan will not start.	OAT set above outdoor ambient temperature	Lower OAT setting.
	Power failure	Call power company.
	Fuse blown or circuit breaker tripped	Replace fuse or reset circuit breaker.
	Defective thermostat, contactor, transformer, control relay, or defrost board	Replace component.
	Insufficient line voltage	Determine cause and correct.
	Incorrect or faulty wiring	Check wiring diagram and rewire correctly.
	Thermostat setting too high	Lower thermostat setting below room temperature.
	Units have a 5-minute time delay	DO NOT bypass this compressor time delay — wait for 5 minutes until time-delay relay is deenergized.
Compressor will not start but outdoor fan runs.	Faulty wiring or loose connections in compressor circuit	Check wiring and repair or replace.
	Compressor motor burned out, seized, or internal overload open	Determine cause. Replace compressor.
	Defective run capacitor or overload	Determine cause and replace.
	One leg of 3-phase power dead	Replace fuse or reset circuit breaker. Determine cause.
	Low input voltage (20% low)	Determine cause and correct.
Three-phase scroll compressor makes excessive noise, and there may be a low pressure differential	Scroll compressor is rotating in the wrong direction	Correct the direction of rotation by reversing the 3-phase power leads to the unit. Shut down unit to allow pressures to equalize.
Compressor cycles (other than normally satisfying thermostat).	Refrigerant overcharge or undercharge	Recover refrigerant, evacuate system, and recharge to capacities shown on nameplate.
	Defective compressor	Replace and determine cause.
	Insufficient line voltage	Determine cause and correct.
	Blocked condenser coil	Determine cause and correct.
	Defective run/start capacitor, overload, or start relay	Determine cause and replace.
	Defective thermostat	Replace thermostat.
	Faulty condenser-fan motor or capacitor	Replace.
	Damaged reversing valve	Determine cause and correct.
	Restriction in refrigerant system	Locate restriction and remove.
Compressor operates continuously.	Dirty air filter	Replace filter.
	Unit undersized for load	Decrease load or increase unit size.
	Thermostat set too low	Reset thermostat.
	Low refrigerant charge	Locate leak, repair, and recharge.
	Leaking valves in compressor	Replace compressor.
	Frosted coil with incorrect defrost operation	Check defrost time settings. Reset as necessary. Check defrost temperature switch. Replace as necessary.
	Air in system	Recover refrigerant, evacuate system, and recharge.
	Outdoor coil dirty or restricted	Clean coil or remove restriction.
Excessive head pressure.	Dirty air filter	Replace filter.
	Dirty condenser coil	Clean coil.
	Refrigerant overcharged	Recover excess refrigerant.
	Air in system	Recover refrigerant, evacuate system, and recharge.
	(Heat) Indoor air restricted or recirculating	Determine cause and correct.
	Indoor or outdoor air restricted or air short-cycling	Determine cause and correct.
Head pressure too low.	Low refrigerant charge	Check for leaks, repair and recharge.
	Compressor valves leaking	Replace compressor.
	Restriction in liquid tube	Remove restriction.

LEGEND

OAT — Outdoor Air Thermostat

Cooling and Heating (cont)

SYMPTOM	CAUSE	REMEDY
Excessive suction pressure.	(Cool) High heat load	Check for source and eliminate.
	Reversing valve hung up or leaking internally	Replace valve.
	Refrigerant overcharged	Recover excess refrigerant.
Suction pressure too low.	(Cool) Dirty air filter	Replace filter.
	(Heat) Outdoor coil frosted	Move timer on control board to 30 minutes between defrost cycles.
	Low refrigerant charge	Check for leaks, repair and recharge.
	Metering device or low side restricted	Remove source of restriction.
	(Cool) Insufficient coil airflow	Increase air quantity. Check filter — replace if necessary.
	(Cool) Temperature too low in conditioned area	Reset thermostat.
	(Cool) Outdoor ambient below 40 F	Install low-ambient kit.
	Field-installed filter-drier restricted	Replace.
Compressor runs but outdoor fan does not.	NC (normally closed) contacts on defrost board open	Check condition of relay on board. Replace if necessary.
Integrated control motor (sizes 048 and 060) IFM does not run.	Motor overload open	Check motor temeprature. Replace motor or capacitor.
	Blower wheel not secured to shaft	Properly tighten blower wheel to shaft.
	Insufficient voltage at motor	Determine cause and correct.
	Power connectors not properly seated	Connectors should snap easily; do not force.
Integrated control motor (sizes 048 and 060) IFM runs when it should be off.	Motor programmed with a delay profile	Allow a few minutes for motor to shut off.
	With thermostat in off state, the voltage on G,Y1,Y,Y2,W with respect to common, should be ½ of actual low voltage supply	If measured voltage is more than ½, the thermostat is incompatible with motor. If voltage is less than ½, the motor has failed.
Integrated control motor (sizes 048 and 060) IFM operation is intermittent.	Water dripping into motor	Verify proper drip loops in connector wires.
	Connectors not firmly seated	Gently pull wires individually to be sure they are crimped into the housing.

LEGEND

IFM — Indoor Fan Motor

Gas Heating

SYMPTOM	CAUSE	REMEDY
Burners will not ignite.	Water in gas line	Drain. Install drip leg.
	No power to furnace	Check power supply fuses, wiring, or circuit breaker.
	No 24-v power supply to control circuit	Check transformer. NOTE: Some transformers have internal overcurrent protection that requires a cool-down period to reset.
	Miswired or loose connections	Check all wiring and wirenut connections.
	Burned-out heat anticipator in thermostat	Replace thermostat.
	Broken thermostat wire	Run continuity check. Replace wire if necessary.
	Misaligned spark electrodes	Check flame ignition and sense electrode positioning. Adjust as necessary.
	No gas at main burners	1. Check gas line for air. Purge as necessary. NOTE: After purging gas line of air, wait at least 5 minutes for any gas to dissipate before attempting to light unit. 2. Check gas valve.
Inadequate heating.	Dirty air filter	Clean or replace filter as necessary.
	Gas input to furnace too low	Check gas pressure at manifold. Match with that on unit nameplate.
	Unit undersized for application	Replace with proper unit or add additional unit.
	Restricted airflow	Clean or replace filter. Remove any restriction.
	Blower speed too low	Use faster speed tap if available, or install alternate motor.
	Limit switch cycles main burners	Check rotation of blower, thermostat heat anticipator settings, temperature rise of unit. Adjust as necessary.
Poor flame characteristics.	Incomplete combustion results in: Aldehyde odors, carbon monoxide, sooting flame, floating flame	1. Tighten all screws around burner compartment. 2. Cracked heat exchanger. Replace. 3. Unit overfired. Reduce input (change orifices or adjust gas line or manifold pressure). 4. Check burner alignment.

LED Troubleshooting — Error Code

SYMPTOM	CAUSE	REMEDY
Hardware failure. (LED OFF)	Loss of power to control module (IGC).	Check 5 amp fuse on IGC, power to unit, 24-v circuit breaker, and transformer. Units without a 24-v circuit breaker have an internal overload in the 24-v transformer. If the overload trips, allow 10 minutes for automatic reset.
Limit switch fault. (LED 2 flashes)	High temperature limit switch is open.	Check the operation of the indoor-fan motor. Ensure that the supply-air temperature rise is in accordance with the range on the unit nameplate.
Flame sense fault. (LED 3 flashes)	The IGC sensed flame that should not be present.	Reset unit. If problem persists, replace control board.
4 consecutive limit switch trips. (LED 4 flashes)	Inadequate airflow to unit.	Check operation of indoor-fan motor and that supply-air temperature rise agrees with range on unit nameplate information.
Ignition lockout. (LED 5 flashes)	Unit unsuccessfully attempted ignition for 15 minutes.	Check ignitor and flame sensor electrode spacing, gaps, etc. Ensure that flame sense and ignition wires are properly terminated. Verify that unit is obtaining proper amount of gas.
Induced-draft motor fault. (LED 6 flashes)	IGC does not sense that induced-draft motor is operating.	Check for proper voltage. If motor is operating, check the speed sensor plug/IGC Terminal J2 connection. Proper connection: PIN 1 — White, PIN 2 — Red, PIN 3 — Black.
Rollout switch fault. (LED 7 flashes)	Rollout switch has opened.	Rollout switch will automatically reset, but IGC will continue to lockout unit. Check gas valve operation. Ensure that induced-draft blower wheel is properly secured to motor shaft. Reset unit at unit disconnect.
Internal control fault. (LED 8 flashes)	Microprocessor has sensed an error in the software or hardware.	If error code is not cleared by resetting unit power, replace the IGC.

⚠ WARNING

If the IGC must be replaced, be sure to ground yourself to dissipate any electrical charge that may be present before handling new control board. The IGC is sensitive to static electricity and may be damaged if the necessary precautions are not taken.

IMPORTANT: Refer to Troubleshooting, Heating chart for additional troubleshooting analysis.

LEGEND

IGC — Integrated Gas Unit Controller
LED — Light-Emitting Diode

START-UP CHECKLIST
(Remove and Store in Job File)

I. PRELIMINARY INFORMATION

MODEL NO.: _____ SERIAL NO.: _____

DATE: _____ TECHNICIAN: _____

II. PRE-START-UP (insert checkmark in box as each item is completed)

☐ VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT

☐ VERIFY THAT CONDENSATE CONNECTION IS INSTALLED PER INSTALLATION INSTRUCTIONS

☐ CHECK ALL ELECTRICAL CONNECTIONS AND TERMINALS FOR TIGHTNESS

☐ CHECK GAS PIPING FOR LEAKS

☐ CHECK THAT INDOOR AIR FILTER IS CLEAN AND IN PLACE

☐ VERIFY THAT UNIT INSTALLATION IS LEVEL

☐ CHECK FAN WHEEL AND PROPELLER FOR LOCATION IN HOUSING/ORIFICE AND SETSCREW TIGHTNESS

☐ SET OUTDOOR-AIR THERMOSTAT (OAT) TO SELECTION BASED ON ECONOMIC BALANCE POINT (EBP). SEE PAGE 22.

III. START-UP

ELECTRICAL

SUPPLY VOLTAGE L1-L2 _____ L2-L3 _____ L3-L1 _____

COMPRESSOR AMPS L1 _____ L2 _____ L3 _____

COMPRESSOR AMPS L1 _____ L2 _____ L3 _____

INDOOR FAN AMPS _____

TEMPERATURES

OUTDOOR-AIR TEMPERATURE _____ DB

RETURN-AIR TEMPERATURE _____ DB _____ WB

COOLING SUPPLY AIR _____

GAS HEAT SUPPLY AIR _____

PRESSURES

GAS INLET PRESSURE _____ IN. WG

GAS MANIFOLD PRESSURE _____ IN. WG

REFRIGERANT SUCTION _____ PSIG

REFRIGERANT DISCHARGE _____ PSIG

☐ VERIFY REFRIGERANT CHARGE USING CHARGING TABLES

☐ VERIFY THAT 3-PHASE SCROLL COMPRESSOR IS ROTATING IN CORRECT DIRECTION

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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